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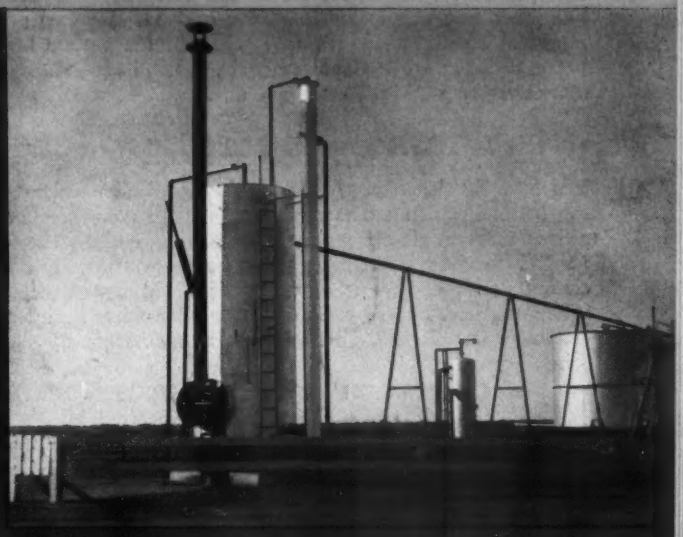
- LOWER FUEL COSTS



Type Y Emulsion Treater shown on typical field location

SPECIALIZED TREATERS

The Type L Treater is designed for the treating of loose type emulsions, replacing the heater and gunbarrel hookup normally used. As the unit is self-contained, a considerable saving is effected in pipe costs and hook-up time.

The Type Y Treater is designed with Maloney-Crawford long-travel wash tray unit, giving the water wash necessary to break the tightest emulsions. No excelsior is used or required with Maloney - Crawford treating units.

Both pressure and atmospheric treaters are fully automatic, requiring a minimum of upkeep and attention.

Maloney-Crawford manufactures specialized Emulsion Treaters to meet your varied treating problems. The Maloney-Crawford design provides for a slow and uniform flow rate eliminating the effect of any extreme fluctuation in the incoming emulsion. The emulsion, rising through the hot water stratum in which the circulation system is submerged, causes effective dehydration due to prolonged washing and scrubbing as well as recirculation of any constituents of the emulsion for practically complete separation before the clean oil passes into the settling chamber. The important advantage of the slow flow rate results in an increase of absorption of heat through the hot water stratum and eliminates the necessity of an excelsior section for any type emulsion. This results in lower furnace temperatures, less shrinkage loss and lower fuel costs.

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PRICE 20 CENTS TABLE OF CONTENTS PAGE 149 **JULY 26, 1947**

CYLINDER OPERATED
Nordstrom Valves
for remote control and emergency operation

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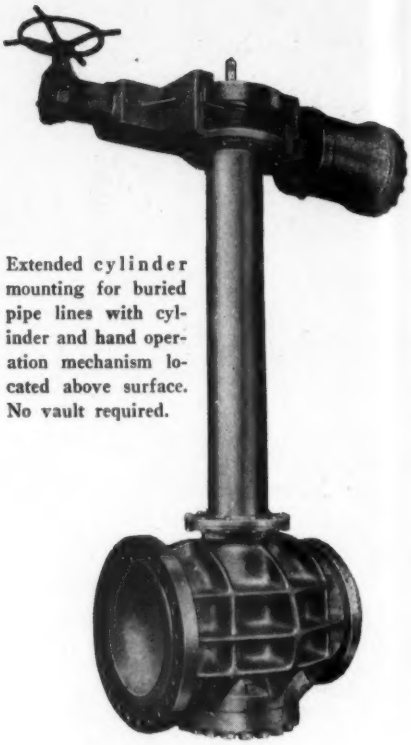

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We have developed automatically closing pipeline valves which can be readily adjusted to any set of high-pressure gas line conditions so as to close immediately following a break but not to respond to changes occurring in normal operation. These self-closing valves on gas transmission lines add a new degree of safety and have proved their worth and dependability in numerous major installations. Full information upon request.

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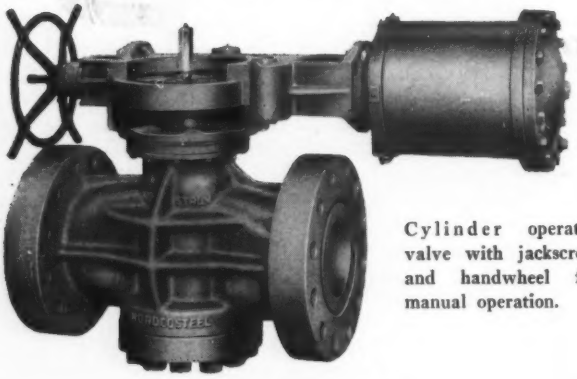
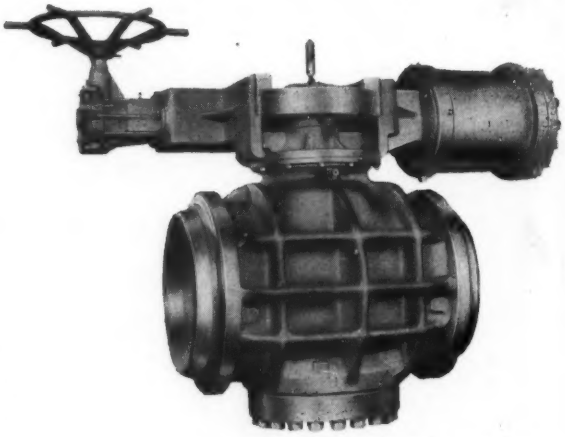
Keep upkeep down



Cylinder operated valve with jackscrew and handwheel for manual operation.

Keep upkeep down



Large cylinder operated valve with bevel drive between jackscrew and auxiliary handwheel.

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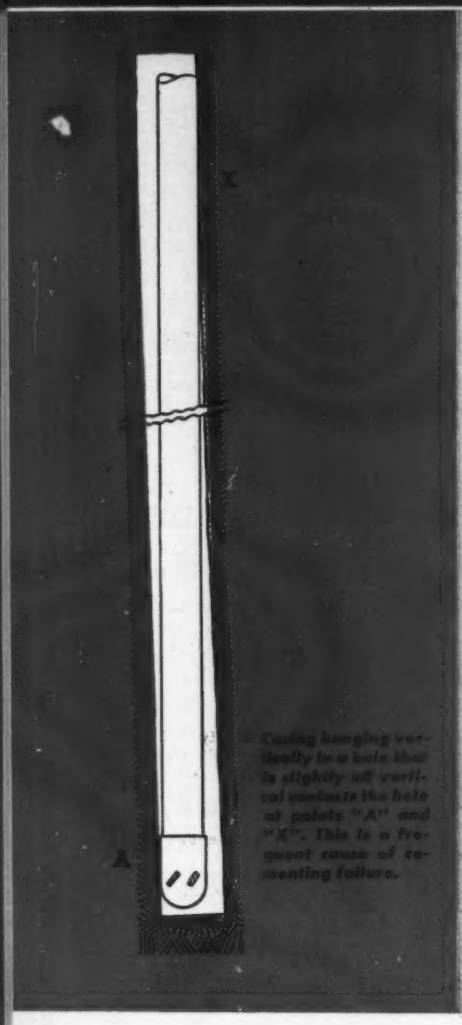
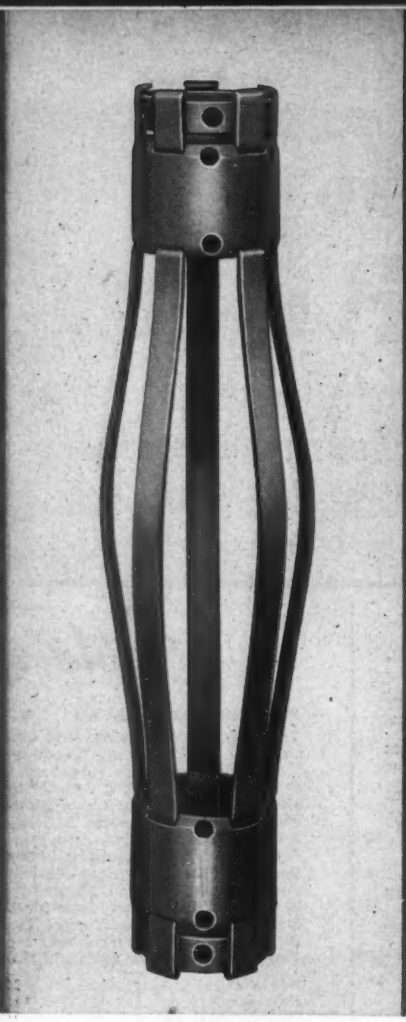
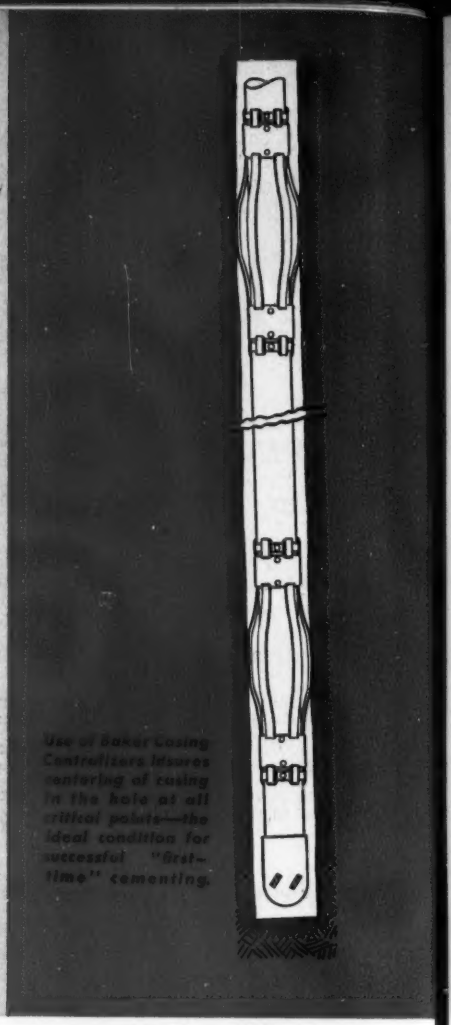


Casing hanging vertically in a hole that is slightly off vertical contacts the hole at points "A" and "X". This is a frequent cause of cementing failure.





Use of Baker Casing Centralizers insures centering of casing in the hole at all critical points—the ideal condition for successful "first-time" cementing.

IT PAYS TO CENTER CASING

When casing is off-center and leaning against the side of the hole at the shoe joint (left view above) the hazard of channeling is obvious. It is also easy to see why so many cementing jobs are failures because it is impossible to place a uniform body of cement ALL AROUND the casing at the vital shoe joint when the casing is not centered. So long as this condition exists, there are sure to be failures to secure good water shut-offs as well as other cementing failures.

Now let's study the drawing at right which illustrates how Baker Casing Centralizers (Product No. 910) provide a uniform annulus for placement of cement entirely around the casing at critical cementing points, and minimize the danger of channeling. Baker Casing Centralizers are simple and effective; they are easy to install and use; they are inexpensive and can be secured promptly through your nearest Baker office or representative.

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THE OIL AND GAS JOURNAL

Progress Through Research

IF the United States ever runs out of petroleum and gas it will make both from coal.

This confident prediction is currently the standard reply to alarmist cries that we should husband our wasting and irreplaceable natural resources. It is made with confidence because our petrochemical industry has already performed similar marvels and the basic processes for this one are well understood.

With equal confidence it is assumed that when this time comes it will be done by the oil and natural-gas industries rather than by the coal and manufactured-gas industries. This assumption is equally well founded because of the petroleum industry's record of progress through research.

This was strikingly brought out during the natural-gas investigation by the Federal Power Commission, which showed that the oil industry is spending more than $100,000,000 annually for research and development (exclusive of petroleum exploration). With a production at that time of 1.7 billion barrels, or 260 million tons, and a refinery value of 3½ billion dollars, its research budget is 3 per cent of its total income, or 40 cents per ton. Still greater expenditures in oil research are assured.

By contrast, the combined coal and coke industries, marketing 700 million tons with a wholesale value of 4 billion dollars, spends only $3,000,000 annually for research (aside from materials-handling equipment), which is 0.4 cent a ton or 0.001 per cent of sales.

Small wonder that the commission observes that the coal and manufactured-gas industries have attempted to resist competition by rear-guard defensive actions which offer no real salvation. The petroleum-refining industry, through its research, has continually lowered its costs, improved its products, and increased the efficiency of utilization by its customers, along with a steady expansion in output.

One coal company, realizing that it was at the tail end of the progress parade of American industries generally, has now begun a research project on gasification and liquefaction of coal, but it is noteworthy that it called on an oil company to join it. However, it is unlikely that the coal industry can ever catch up on its research sufficiently to capture the synthetic-fuels business by the time there is economic justification for it.

As long as the oil industry continues its many research programs—and there is no hint that it will not—the American public can justifiably depend on the promise that synthetic fuels will be available if and when natural gas and petroleum peter out.

And it will be the oil industry rather than the coal industry which will do it because petroleum has always made progress through research.

Enormous Demand on West Coast Points to Import Possibility

THE California oil industry is gradually coming to the hard realization that the state's own indigenous production may fail to satisfy the tremendous increase in demand for petroleum products on the West Coast.

California's production is running at its highest peacetime level and only slightly below the wartime peak. Last week's production was 918,000 bbl. daily. Production for the first half of this year was a record 170,790,000 bbl.—14,057,000 bbl. over the first half of 1946 and 4,989,000 bbl. above 1945's first half.

Despite this effort on the part of the California industry, there are indications the West Coast is outgrowing its supply of fuel, both oil and natural gas. In the absence of major discoveries—and this is an important qualification — the production curve appears likely to turn gradually downward while the demand curve continues to move higher.

No Worse Than Midwest

At the present time, supply difficulties in California are no worse than in some other sections of the country, particularly the Midwest. However, the long-term outlook is that the Pacific Coast, long regarded as a separate petroleum province, will be forced to draw increasingly on the interior for supplemental supplies.

This likelihood is pointed up by the current construction of the natural-gas pipe line to Los Angeles by El Paso Natural Gas Co., Southern California Gas Co., and Southern Counties Gas Co. Scheduled for completion this fall, the line at maximum capacity will give Southern California more than 300,000,000 cu. ft. daily—natural gas which is admittedly not available from California sources.

A month ago a second natural-gas line from West Texas to California was revealed to be in the planning stage. Paul Kayser, El Paso Natural president, conferred in San Francisco with officials of Pacific Gas & Electric Co. on the proposal. El Paso Natural's affiliates have been expanding their gas reserves in the Southwest *(see page 293)*.

Movement from Southwest

Crude-oil movement from the Southwest also is planned. In May Shell Oil Co., Inc., which has heavy producing and refining interests on the West Coast, was reported heading a group of companies making arrangements for a 20-in. line from Midland, Tex., to the California refining center at Wilmington.

Standard Oil Co. of California, the major West Coast operator, recently announced plans to build a crude-oil line from the Rangely, Colorado, field to Salt Lake City, and there has been considerable speculation as to whether this would be the first section of a line to California. The company may build a refinery in Salt Lake City and hinge its further plans on the development of additional production in the Rocky Mountain section.

Under the present petroleum price structure, it appears to be economically sound to build pipe lines extending the thousand or more miles from interior areas to the Pacific Coast at a cost of many millions. Cost of moving 150,000 bbl. daily through the Shell line is estimated at about a third of that for moving Venezuelan oil to the West Coast by T-2 tanker through the Panama Canal. The natural-gas pipe line now under construction is expected to deliver gas into Southern California at 16½ cents per M.c.f.

No Cause for Alarm

Far-sighted leaders of the oil industry in California see no need for alarm in the situation. They expect to continue to meet all demands for primary petroleum products. But at the same time, many of them concede their task may be complicated and made more difficult by the ever-growing demand.

California's oil reserves are large. They continue to rank among the foremost in the nation, although the decrease in reserves during 1946 was the greatest of any state. The Oil and Gas Journal's report as of January 1, 1947, estimated California reserves at 3,349,148,000 bbl., a 15.7 per cent drop from the estimate a year earlier. The American Gas Association placed California's gas reserves as of January 1, 1947, at 11,126,301,000,000 cu. ft., a gain of 270,594,000,000 cu. ft. during 1946.

To maintain their production position, the California industry is now engaged in a widespread exploration program. Compilations in this Mid-year Issue indicate the state will drill 297 more wells, including 23 more wildcats, and approximately 1,447,000 more feet the last half of 1947 than in the same period of 1946. Reports also show rotary rigs operating on the Pacific Coast total 144 against 127 last February and 133 a year ago.

With no coal, the West Coast has long moved with oil as the basis of its fuel economy. For years petroleum has been relatively cheap in the area. This has encouraged consumption which is pushing steadily upward. Realizing that no major fields have been discovered in California in 10 years and that wildcatting in the Pacific Northwest has yielded discouraging results, some economists predict production will be down to 800,000 bbl. daily by 1950. R. L. Minckler, General Petroleum Co. executive vice president, has been quoted as estimating by that time the state will need 97,000 bbl. daily from the more abundant supplies of the Southwest and Rocky Mountain regions.

The tremendous gains in population along the Pacific Coast in the last few years have been a significant factor in raising consumption of petroleum. Use of automobiles is probably the greatest in any area in the country. California led all states in 1946 gasoline consumption.

Repressuring Operations

In the past, vessels stocked heavily on fuel oil when calling on the West Coast. Prior to the last increase, fuel oil cost $1.45 at Los Angeles compared with about $1.73 at the Gulf Coast and $2.22 in New York. Recent raises have somewhat offset this disparity. The West Coast also leans heavily for power on hydroelectric operations, and low water levels this year added to the demand for fuel oil to operate standby equipment.

California industrial fuel consumers are finding gas shorter than oil. To increase recovery, California oil operators are using more and more of their gas for repressuring and lifting operations. Some 300,000,000 cu. ft. daily is estimated going into these oil-field operations.

The position in which the California industry finds itself today was summarized last November by Graham B. Moody, Standard Oil Co. of California, in a paper before an American Association of Petroleum Geologists meeting:

"Despite the drain on California's oil resources by World War II, production in the middle of September 1946 was about 870,000 bbl. daily. The average during 1941 was about 631,000 bbl. During the period 1941 to 1945, inclusive, the discovery of new pools and new fields in California added estimated reserves equal to about one-third of production during that period. Additional reserves must be discovered in order to continue to meet the unprecedented peacetime demand for California oil. More new pools in present producing areas probably will add larger amounts to reserves than will new fields (tidelands excepted). It will require intensive geological effort to find these new reserves. . . ."

Refinery Runs, Gasoline Production Establish All-Time Records

DURING the week ended July 12 the nation's refineries ran an average of 5,229,000 bbl. of crude oil to stills daily and produced a total of 16,197,000 bbl. of gasoline, the largest crude runs and the greatest gasoline production in any week in the history of the country's oil industry.

Crude runs averaged 89,000 bbl. daily above the previous record of 5,140,000 bbl. daily, set during the week ended August 18, 1945, in the closing days of the war. Gasoline production was 91,000 bbl. above the total of 16,106,000 bbl. produced during the previous record week which ended July 28, 1945.

Both crude runs and gasoline production were well above the figures of a year ago.

For crude runs, July 12 marked the end of the fourth consecutive week showing increases, and the seventh consecutive week with crude runs of 5,000,000 bbl. daily or greater.

Near Total Capacity

The weekly report of the American Petroleum Institute showed that operations were at a rate of 93.3 per cent of the total United States refining capacity. The figures were based on reports on operations of 89.4 per cent of the country's refining capacity.

The Louisiana Gulf Coast area showed the greatest gains, increasing its crude runs more than 20 per cent during the past year and nearly 35 per cent since the previous record week in 1945.

The Texas Gulf Coast area, largest refining center in the nation, increased its crude runs 57,000 bbl. daily between July 13, 1946, and July 12, 1947, but showed an increase of only 7,000 bbl. daily this year compared with the August 1945 figure.

Other significant increases, compared with the year-ago figure, were shown by the East Coast area, up 91,000 bbl. daily; Appalachian area, up 32,000 bbl. daily, and the Oklahoma-Kansas-Missouri area, up 31,000 bbl. daily.

Crude runs have shown a continued increase since the week ended April 5, when they averaged only 4,772,000 bbl. daily, lowest figure this year.

Stocks Show Drop

The increase in crude runs and in gasoline production have coincided in recent weeks with dropping stocks of crude oil and falling crude production.

Even with the record production of gasoline, stocks of the finished material at refineries, bulk stations, in transit, and in pipe lines have shown a steady drop in recent weeks. On June 14 gasoline stocks were estimated at 93,356,000 bbl., but on July 12 had dropped to 88,791,000, a decline of 4,565,000 bbl. Stocks on July 13, 1946, were 90,807,000 bbl.

In the Midwest, where transportation difficulties have created the most serious shortage of petroleum products, there was no appreciable increase in gasoline production or crude runs. This reflects crude transportation difficulties.

TABLE 2—RECENT REFINERY RUNS, GASOLINE PRODUCTION
(Figures in barrels)

Week ending—	Runs to stills (daily ave.)	Gasoline prod. (for week)
May 31	5,000,000	14,709,000
June 7	5,148,000	15,350,000
June 14	5,164,000	15,695,000
June 21	5,078,000	15,682,000
June 28	5,093,000	16,070,000
July 5	5,109,000	15,759,000
July 12	5,229,000	16,197,000

TABLE 3—PRODUCTION AND STOCK TRENDS
(Figures in barrels)

Week ending—	Crude oil— Daily ave. prod.	Crude oil— Stocks	Gasoline stocks
June 21	5,123,295	235,660,000	91,877,000
June 28	5,115,635	236,221,000	91,806,000
July 5	5,079,160	233,810,000	89,674,000
July 12	5,044,170	232,361,000	88,791,000

TABLE 1—CURRENT, YEAR EARLIER, AND PREVIOUS HIGH—CRUDE RUNS AND GASOLINE PRODUCTION
(Figures in 1,000 bbl.)

Week ended / Area—	Crude runs to stills, daily ave. July 12, 1947	July 13, 1946	Aug. 18, *1945	Gasoline prod., weekly total July 12, 1947	July 13, 1946	July 18, *1945
East Coast	907	816	810	2,261	1,942	1,934
Appalachian	169	137	168	527	413	460
Ind., Ill., Ky.	797	775	779	2,890	2,694	2,952
Okla., Kans., Mo.	421	390	410	1,525	1,308	1,478
Inland Texas	247	230	251	1,095	957	1,013
Texas Gulf	1,255	1,198	1,248	3,907	3,560	4,115
La. Gulf	424	332	282	1,133	972	974
N. La., Ark.	65	59	76	171	141	255
Rocky Mountain	140	137	137	428	435	416
California	804	801	979	2,260	2,294	2,509
Totals	5,229	4,875	5,140	16,197	14,716	16,106

*Previous record for United States.

Michigan Crude Price Advanced 8 Cents

SAGINAW, Mich.—Well-head price of Arenac County crude advanced 8 cents a barrel to $2.05 as Michigan pipe-line companies all met the advance posted July 19 by Leonard Pipe Line Co., Mount Pleasant.

The advance narrows the gap between the so-called black crude from Arenac fields and other Michigan oil. Arenac crude, slightly heavier, has a slightly lower ratio of refined recovery.

With one exception, the increase does not affect prices of other Michigan crude. Simrall Corp. equalized at $2.05 the former $1.94 for West Branch crude, $1.94 for Clayton, and $2.01 for Richfield and Foster crude.

Oil interests said the increase was purely competitive for the output of the state's leading producing area and is justified by demand. Reports that the increase was linked with the start of operations in the new catalytic cracking plant of Leonard Refineries, Inc., at Alma, were denied by a refinery official who pointed out that the pipe line and refinery are separate corporations.

Agreement Not Reached On California Operations

WASHINGTON.—Agreement between the State of California and the Department of Justice on control of oil operations along the Pacific Coast "tidelands" was still undecided this week in spite of the fact that the state attorney general announced last week that a stipulation had been signed.

It was learned that a tentative agreement had been reached and approved by state officials, but in the meantime the department reneged and suggested changes. It is understood that in its present form the stipulation provides for continued operation of all wells draining submerged oil sands. Payment of royalties to state and cities to be held in escrow for final determination, and boundary lines for various bays and harbors which would exclude the bulk of the wells at Long Beach and some other points from federal jurisdiction. This stipulation will be only an interim working agreement, subject to change when a final decree is entered by the supreme court.

$4,500,000 Cycling Plant Opened In Lake St. John Field

by Neil Williams

PROCLAIMED by Commissioner Joseph L. McHugh of the Louisiana Department of Conservation as an outstanding example of true conservation effort, gas-cycling operations starting in Lake St. John field, in Tensas and Concordia parishes, are expected to increase the field's recoverable oil reserves more than 30,000,000 bbl. and add approximately 10,000 bbl. of liquid hydrocarbons to its daily productivity.

McHugh and other conservation, state, and parish officials, along with representatives of various operating and royalty interests in the field and community and civic leaders in surrounding cities and towns, comprised a group which was conducted on an inspection tour of the field July 19 to observe the inauguration of the $4,500,000 gas-cycling project. *(A picture of part of the facilities appears on the opposite page.)*

The cycling plant, construction of which was started in 1946, has facilities for processing approximately 100,000,000 cu. ft. daily. So far, only facilities for handling the crude-oil production and the compressors for returning gas to the producing formations are in actual operation. Installation of facilities for recovery and processing of liquid hydrocarbons is nearing completion and will be in operation in the near future. Products, in addition to crude oil, will consist of rectified condensate, natural gasoline (including butane), and propane.

Believed a "First"

Lake St. John, located on the west side of the Mississippi River, approximately 20 miles from Natchez, Miss., is believed to be the first field in which unitization has been applied both to oil production and to gas cycling in a single project. Involved are the main basal Tuscaloosa sand at 9,000 ft. and an 8,150-ft. sand. Unitization has been on a voluntary basis and embraces approximately 95 per cent of field's total productive area of about 14,000 acres. Participating in the unit are The California Co. with 75 per cent interest, Carter Oil Co. with 21 per cent, and Magnolia Petroleum Co., Skelly Oil Co., and Royal Oil & Gas Co. with the remaining 4 per cent.

Pending inauguration of the cycling project, high-ratio and gas-condensate wells completed during development of the field have been shut in in the interest of conservation. Development has been directed toward proving up the narrow rim of oil in the downstructure phases of the sands around the gas-cap area, and the only gas wells are those which inadvertently were located a little too high updip.

Recoverable Reserves

Recoverable reserves of crude and other petroleum hydrocarbons, with cycling operations being started, are estimated at more than 111,000,000 bbl., including 64,224,000 bbl. of crude, 32,690,000 bbl. of condensate and 14,000,000 bbl. of butanes and propanes. With continuation of ordinary productive methods, recoverable reserves were calculated at only 81,000,000 bbl. Present daily production without operation of the products recovery plant is approximately 13,800 bbl. of crude oil and 1,600 bbl. of condensate. Gas reserves are estimated at 455 billion cubic feet, which by return to the formations, will be conserved for future use.

The 70 odd members of the field inspection party were guests of The California Co. for the day. Following lunch served in the field at noon, K. H. Crandall, president of the company, presented a brief discussion of the general geology of the field. Dr. John J. Mullane, petroleum engineer, Carter Oil Co., outlined some engineering aspects of the cycling program. McHugh told of the progress made by Louisiana operators along conservation lines. The day was closed with a steak dinner at the Eola Hotel in Natchez.

$30,000,000 Lube Plant To Be Built

CONFIRMATION of the joint plans of Cities Service Co. and Continental Oil Co. to form a new company, Citron Corp., for the manufacture of solvent-refined lubricating oils, was made in New York late last week. Construction contracts have been awarded to the Lummus Co. and Max B. Miller Co. Construction is slated to start this fall.

The plant is designed to have a daily production capacity of 6,000 bbl. of 95 VI oils and will include facilities for making various grades of bright stocks, neutral oils, and fully refined crystalline waxes.

The plant will be erected on a 162-acre tract recently purchased from the U. S. Government, near the refineries of Cities Service and Continental at Lake Charles, La. Estimated cost is $30,000,000. It will be 65 per cent owned by Cities Service and 35 per cent by Conoco, with executives of the two corporations comprising the board of directors.

W. Alton Jones, president of Cities Service, has been elected board chairman. Burl S. Watson, vice president of Cities Service, is president. Citron's vice presidents are H. G. Osborn, Conoco vice president, and A. P. Frame, vice president of Petroleum Advisers, a Cities Service subsidiary. Remaining directors are H. L. O'Brien, L. D. Mann, and G. L. Mateer of Cities Service, and E. F. Battson, Serge B Jurenev, and F. W. Mann of Conoco.

F. M. Simpson has been appointed resident general manager, B. R. Johnstone, secretary, and C. E. Weger, treasurer.

Humble Shelves Plans For Offshore Drilling

Humble Oil & Refining Co. officials said July 21 in Houston the company has decided to postpone drilling operations on Louisiana offshore holdings pending action by courts or Congress on submerged lands.

A Humble statement said that during the last year the company leased 10 blocks from Louisiana for development in the Gulf of Mexico and entered into contracts for the building of drilling platforms in preparation for immediate drilling. Expenditures already have reached $2,500,000, they said.

The statement said that due to the decision of the U. S. Supreme Court involving submerged lands off California, Humble has decided to postpone drilling operations. Magnolia Petroleum Co., which owns large offshore holdings, said land drilling is continuing but made no comment on the future of offshore operations.

Bill Curbing Exports Approved by Committee

A bill to block petroleum shipments to any foreign country unless the United States secretary of commerce certifies that the exports will not interfere with national defense or security, was approved early this week by the merchant-marine committee of the House.

The bill was scheduled for House consideration late this week or early next week. It would require monthly reports to Congress by the commerce secretary.

this week

RECORDS— Nation's refineries turn in greatest performance in industry's history during week ended July 12. . . . A.P.I. report lists refinery runs at 5,229,000 bbl. daily, 89,000 bbl daily above the previous all-time high the week ended August 18, 1945. . . . Second record set in gasoline production with total output during the week of 16,197,000 bbl., 91,000 bbl. above the previous high the week ended July 28, 1945. . . .

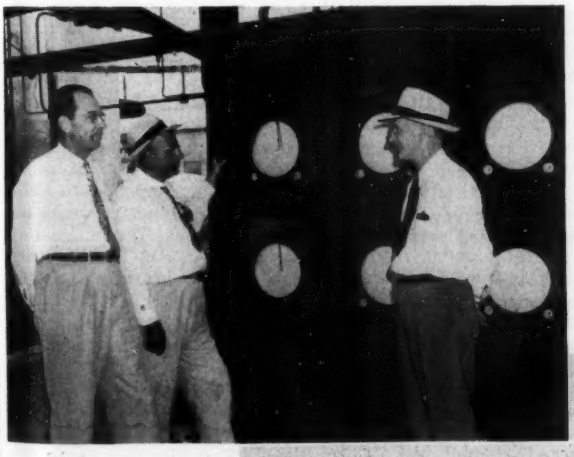
REFINING—Cities Service, Continental announce plans to construct $30,000,000 lubricating-oil plant near Lake Charles. . . . New corporation, Citcon Corp., acquires 162-acre site with construction scheduled to start this fall. . . . ¶Imperial reveals plans for new refinery of about 12,000-bbl. daily capacity at Edmonton, Alta., to handle crude from the new and rapidly developing Leduc field. . . . ¶More than 100 refinery executives and engineers inspect country's first two small-scale catalytic cracking plants, visiting U.O.P. unit at Aurora Gasoline Co. in Detroit and T.C.C. plant at Leonard Refineries in Alma, Mich., in tours sponsored by W.P.R.A. . . .

NATURAL GAS— Moves by several major gas purchasing companies to raise prices to producers in the Southwest reported. . . . Southern Natural reported contracting for gas from Gwinville field, Mississippi, at 7 1/2 cents per M.c.f. . . . Chicago Corp. reported contracting for gas production from Jefferson pool, Marion County, Texas, on graduated plan with 7 1/2-cent price the first 5 years. . . . Amarillo reports say Sinclair Prairie, Shell sending letters to landowners designed to increase sour-gas royalty payments. . . .

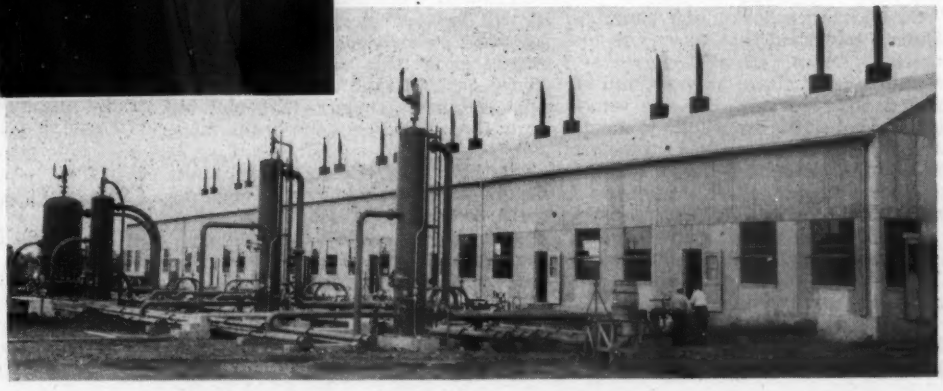
EXPORTS— Continued pressure in Congress for ban on petroleum imports during current period of under supply results in approval by House merchant marine committee of bill to block exports unless certified by secretary of Department of Commerce. . . . Little chance seen that Congress will take any action on the report before adjournment later this month. . . .

TIDELANDS— Humble Oil & Refining Co. announces decision to withhold drilling operations on offshore holdings along the Gulf Coast pending complete clarification of the "tidelands" issue by the courts or Congress. . . . Company had already contracted for drilling platforms. . . . ¶Governors' Conference at Salt Lake passes resolution calling on Congress to enact legislation returning title to submerged coastal areas to the states. . . . ¶California legal officials file petition for rehearing of decision in U. S. Supreme Court. . . .

EXPLORATION—Sinclair Prairie and Atlantic wildcat in northeastern Crockett County, Texas, recovers 10,000,000 cu. ft. gas and 60 ft. distillate on drill-stem test in Ellenburger. . . . ¶Sunray well in Goliad County, Texas, is prospective pool opener in Luling sand at 7,709 ft. . . . ¶Gas-condensate pool opened in Aransas County, Texas. . . . ¶Atlantic opens Southwest Eola pool, Avoyelles Parish, Louisiana, with well making 186 bbl. 44.7°-gravity oil. . . . ¶Shell Oil Co. deep sand well in Long Beach, Calif., flowing 1,120 bbl. 32.7°-gravity oil. . . . ¶Leduc fields southwest of Edmonton, Cañada, getting fifth completion. . . .



K. H. Crandall (left), president, and Tom Flood (right), vice president, The California Co., pause with Commissioner Joseph L. McHugh, Louisiana Department of Conservation, in front of one of the instrument boards in the new Lake St. John gas-cycling plant



Compressor plant in Lake St. John gas-cycling plant showing suction and discharge header system with some of the scrubbers and accumulator tanks in foreground. Plant contains nine 800-hp. units. Installation is so new operators have not had time to clean and improve the site or paint the equipment and lines *(see story, opposite page)*

No Need for Oil Imports, Malone Insists at Hearings

by Henry D. Ralph

WASHINGTON.—The printed record being built up by the economic resources subcommittee of the Senate committee on public lands will be a useful reference volume on the current petroleum situation, but the hearings of the past week brought out only one point—that the United States can supply its own needs for oil and does not have to depend on foreign sources.

This appeared to be the only conclusion of interest to the chairman, Sen. George W. Malone of Nevada.

Spokesmen for various branches of the oil industry and a number of different government agencies appeared and presented much data which Malone, the only committee member present 99 per cent of the time, let go into the record without much notice. But he tried to pin every witness down to an admission that there is no need to import oil and that the domestic petroleum industry can provide domestic requirements if given a chance without impediments.

The freshman senator considers his group as the successor to the special Senate committee on petroleum resources which was headed during the previous two Congresses by Sen. Joseph C. O'Mahoney of Wyoming. His hearings, which have been running for many weeks, are an attempt to lay the basis for greater development of mineral resources of the western states and for less dependence on foreign sources of strategic materials. The oil hearings were moved up on Malone's schedule because of the recent shortage scare, but they failed to bring out much information not already rather well known.

Too Much "Loose Talk"

Several times during the hearings, Malone remarked that there was too much loose talk about how we are running out of oil or minerals, and he issued an open invitation for somebody who could lay claim to being an expert on petroleum to appear before the committee and make the statement that the United States is a have-not nation as to oil.

The hearings were barely concluded when Malone issued a statement declaring that the oil shortage is a myth.

The admission that the oil of the Middle East could not safely be counted on as a military reserve in case of another war was made by Vice Adm. John H. Hoover, chairman of the Army-Navy Petroleum Board, during the hearings.

Aides kept suggesting that military matters perhaps ought to be discussed in executive session, but Senator Malone persisted until he got the answer he wanted. He also got it on the record that ANPB gives top priority to maintaining the production capacity of the domestic oil industry and that imports should not be so large as to discourage development within our borders.

The admiral told him that for the fiscal year just starting the military would require about 107,000,000 bbl. of all petroleum products and expected to obtain 77 per cent in the United States and 23 per cent abroad, the foreign purchases to be used outside of this country. He added that about the same quantities will be needed annually so long as occupation of former enemy territories is continued.

Progress in Synthetic Fuels

In case of emergency, some 2,000,000 bbl. a day of synthetic liquid fuels could be produced within a period of 2 to 4 years provided unlimited funds, materials, and manpower were available, the committee was told by Dr. W. C. Schroeder, head of the synthetic fuels project of the Bureau of Mines.

But, he said, given a few more years of research, a much better showing could be made, since fuels synthesis is today about where synthetic rubber was at the time of Pearl Harbor. He did not hold out synthetic fuels as a complete safeguard against an emergency, predicting rather that this industry will develop slowly as technology improves and economic conditions warrant. The prospects for this are getting better every day, he said, and some recent spot oil prices suggest that fuel oil from shale could compete in the market today.

At the cost of about $2 per barrel, Schroeder said, shale can be made to yield a low grade crude somewhat comparable to crude petroleum selling at $1.25 to $1.75 per barrel. Because of its low grade, shale oil should not be considered a good source of gasoline but will find a place as a source of diesel and fuel oil.

Coal processes are not as far advanced as those based on natural gas and shale, but if forced to go into production with them today he estimated that a hydrogenation plant could produce products at 13 cents a gallon, and assuming that byproducts would bring 3 to 6 cents a gallon, gasoline could sell for between 7 and 10 cents at the plant. The Fischer-Tropsch process, he testified, needs much more engineering before the first plant can be built with much hope of success, but on the basis of present knowledge it might yield gasoline at a cost of 8 to 10 cents per gallon.

Schroeder urged continuation of the Government's synthetic fuels research but warned that for the immediate future it can be considered only as a possible cushion against increasing consumption, along with new crude discoveries, secondary recovery, and development of the Continental Shelf, and that economic developments will determine which of these possibilities will become most important.

Additional Tankers to Be Sold

Another witness, Adm. W. W. Smith, chairman of the U. S. Maritime Commission, said all of the war-built T-2 tankers which are suitable for commercial operation will be in service within a short time.

The Navy, he said, has recently given permission for the sale of an additional 100 of these tankers for foreign registry, and since there are 140 foreign applications pending they will be sold as quickly as they can be put into shape. Half of these will be taken from the operating fleet and half from the reserve fleet, leaving in reserve only about 50 tankers all of which are of special military types or otherwise not well suited to commercial use.

At the moment the commission is operating 219 tankers and when foreign sales are completed it will have 169 of which it expects to sell about 50 to domestic operators and to Panamanian companies wholly owned by United States citizens. This will leave 119 tankers which the commission may operate until March 1. Smith said he did not know what the situation may be when this operating authority expires, but in the meantime these tankers should be able to take care of all world requirements. All military and domestic requirements are being met at present, but foreign trades are given a pro rata allotment of remaining tonnage.

Carter Donates Gravimeter

Carter Oil Co. has presented the University of Tulsa geophysics department with a gravimeter which will be installed in the college of petroleum sciences and engineering and used for research and undergraduate instruction.

Indiana Standard Memo Provides Facts on Russian Oil Shipments

TO aid in correcting any public misconceptions, Standard Oil Co. (Ind.) has distributed a memorandum within its organization pointing out that current products supply problems in the Midwest are not the result of oil shipments to Russia.

The data, which was sent to employes of the company and dealers in its products, explains that Indiana Standard is not an exporter to Russia but that the Soviet shipments are far below those of 1946 and are negligible compared to United States requirements.

The memorandum follows:

Press comments and incoming letters indicate that there is in the minds of some of our customers a false impression that short supply conditions with respect to gasoline are the result of shipment of oil to Russia. To assist you to answer intelligently questions that may be asked you on this subject, we pass on to you the following information, much of which is available in public records for anyone who desires to investigate:

1. Standard Oil Co. (Ind.) has not shipped a single gallon of oil products to Russia. As a company it is not involved in any way in such shipments.

2. For the past several months the United States has been importing more oil than it has exported. If all foreign trade were stopped, we would be net losers.

3. In fairness to whatever companies have made shipments to Russia, it may be pointed out that such shipments, as shown by government records, have been at a rate of less than 1,500 bbl. a day this year as compared with an average rate of 6,889 bbl. daily for the whole of 1946. The current shipments are a negligible quantity in comparison with United States needs. (Less than three one-hundredths of 1 per cent).

4. Shipments to Russia are made with full knowledge of the U. S. Government, the latter having the responsibility to decide whether it is good policy or not to ship oil to Russia or any other country. The general rule in international trade is for all companies and all nations to trade freely with each other unless their governments decree otherwise.

5. The shortage in the Middle West would not have been lessened if no oil had been shipped to Russia. The main difficulty here is lack of transportation facilities to bring oil in from other areas. Our inability to bring adequate quantities from relative nearby points in Texas and Oklahoma suggests the difficulty in moving into this area the products shipped from the West Coast to Russia.

It has been our observation that individuals will assume a constructive attitude when they "know the facts" pertaining to a given situation. We believe you will have a similar experience in using the information in this memorandum. In the interest of good relations with the public, the oil industry should not allow the impression to exist that oil shipments to Russia are responsible for current supply difficulties in the United States.

Rizley Bill Shelved; Eminent-Domain Passes

WASHINGTON. — Amendment of the Natural Gas Act at this session of Congress was definitely killed late last week when the Senate commerce committee, by a vote of 6 to 5, refused to report out the Rizley bill (H.R. 4051) which had been passed by the House a few days earlier.

The vote was explained partly by a desire to avoid bringing any new controversial matters to the floor of the Senate during the closing days of the session, but partly because of a growing opposition to the measure. Opponents have been quoting figures of gas reductions under orders of the Federal Power Commission and have been saying that the Rizley bill would make it impossible for FPC to regulate gas rates effectively.

As matters now stand, the committee can reconsider its action at the next session, either with or without additional hearings on the measure. In the meantime it is expected that FPC will have completed the report on its natural-gas investigation, which promises to include recommendations for fixing the field price of gas. This could lead to reopening the matter before the Senate committee with a view to harmonizing the views of the natural-gas industry with whatever proposals FPC may make. *(For comments on this situation, see Watching Washington, page 164).*

Another measure affecting the natural-gas industry, the Schwabe bill to amend the Natural Gas Act by permitting interstate gas pipe lines to condemn property for rights-of-way, has been passed by both House and Senate and sent to the White House.

The bill would prefer power of eminent domain on a natural-gas company for purposes of constructing a pipe line authorized by a certificate of public convenience and necessity from the FPC. Most other public utilities have this right, and gas-company officials testified that they have been forced to pay extortionate prices for rights-of-way in some cases. There was little opposition to the bill and it was approved by FPC.

Michigan-Wisconsin Contracts Bring Suit

PHILLIPS PETROLEUM CO. and Michigan-Wisconsin Pipe Line Co. have brought suit in federal District Court in Tulsa against Skelly Oil Co., Stanolind Oil & Gas Co., and Magnolia Petroleum Co. requesting that they be ordered to deliver natural gas from leases on 189,528 acres in Hugoton field.

The dispute centers around the alleged issuance of a Federal Power Commission certificate of public necessity and convenience for construction of a proposed gas line from the Hugoton field to Michigan and Wisconsin. Phillips signed gas contracts with the three companies containing termination provisions in the event the certificate not be issued before December 1, 1946, according to the petition.

The petition further states that Phillips entered into contracts for gas from 45,528 Skelly acres and 118,000 Stanolind acres on December 5, 1945, and contracted for 25,000 Magnolia acres 2 days later. Phillips claims that in each contract reference was made to the desire of the pipe-line company to obtain a certificate which would obligate Phillips to furnish gas reserves. On December 11, 1945, Phillips and Michigan-Wisconsin signed a contract.

The certificate in dispute was issued November 30, 1946, Phillips alleges, but this is disputed by defendants who claim that proceedings of the FPC prior to December 1 did not "amount to issuance of the certificate." The petition says that on December 2, 1946, each defendant sent telegrams to Phillips announcing termination of contracts and that replies were sent the following day claiming the validity of the contracts.

Panhandle Eastern Pipe Line Co. has been fighting the construction of the line in the courts. It contends that it has rights under the "grandfather clause" of the Natural Gas Act to serve the Detroit area. Panhandle Eastern has asked the U. S. Court of Appeals in the District of Columbia to set aside the FPC order granting the certificate to Michigan-Wisconsin.

International

WORLD-WIDE OIL DEVELOPMENTS

Court Denies Order to Produce Aramco Concession Documents

IN a move to protect Arabian American Oil Co. and the governments of the United States and Saudi Arabia from annoyance and embarrassment, Judge F. G. Caffey, in the U. S. District Court in New York, last week quashed a subpoena that would have required Aramco to produce in court the original text of the oil concession obtained from Saudi Arabia's King Ibn Saud.

The subpoena was issued June 19 by Judge E. A. Conger on the application of James A. Moffett, former oil executive and former federal housing administrator, in his suit against Aramco for $6,000,000 he claims is due him for past services (The Oil and Gas Journal, February 1, page 28).

The motion to quash the subpoena was granted without comment after James Terry Duce, Aramco vice president, testified that the Saudi Arabian Government regards the concession data as "confidential documents" and does not desire their publication. Duce explained that "Saudi Arabia has oil interests on which the United States is increasingly dependent," and added

International Situation Delicate

"It is an area in which the international situation is delicate. Its views with respect to an agreement which provides a major source of its income are entitled to respect and the Government of the United States has an interest in whether any action should be taken which would be contrary to the wishes of the Saudi Arabian Government."

Duce submitted to the court copies of letters written by Moffett to the Saudi Arabian Embassy early last year, the texts of which have been published in part (The Oil and Gas Journal, May 3, page 51). These letters proposed that King Saud expropriate Aramco's holdings and that a new company be formed whereby Moffett would hold 49 per cent interest, in return for which he suggested that present royalties would be increased.

These offers were declined by Asad Al-Faquih, Saudi Arabian minister to the United States, who said the relations between his Government and Aramco "were extremely satisfactory," and that "I can see no reason for my government to expropriate the Arabian American Oil Co. in view of its continued cooperation with both the government and the people of Saudi Arabia."

Jersey Tanker Carrying Propane to Brazil

THE first Standard Oil Co. (N. J.) tanker, which eventually will be one of a small fleet carrying propane to Latin America, is now en route to Rio de Janeiro with a cargo of 100,000 gal. to provide a convenient fuel for sections of Brazil where charcoal, wood, kerosine, and small amounts of coal now are used in homes and factories.

The Esso Sao Paulo will make regular runs between Aruba and Rio de Janeiro and Santos, Brazil. In addition to liquefied gas, the tanker has space for several thousands of barrels of gasoline, kerosine, and other white oils. This is the first bulk trans-

Pipes and valves aboard the Esso Sao Paulo through which L.P.G. is taken on or discharged. The lines can be connected from onshore supply lines or railway tank cars on floating barges to four tank domes, one of which is shown protruding above the deck. Through these the gas is driven into the specially built tanks below deck by steam-driven high-pressure pumps. [Standard Oil Co. (N. J.) photo]

port of propane in a tanker to Latin America.

Commenting on this operation, company officials pointed out that distribution of L.P.G. by bulk import in large tankers is expected to represent another contribution toward the Brazilian Government's program to stabilize prices and improve standards of living. The propane will be distributed by Cia. Nacional de Gas Esso, jointly owned by Brazilian business and Jersey Standard.

While the chief uses of propane in Latin America will be in the home for gas ranges, refrigerators, and water heaters, it is also expected to have extensive use in those industries and commercial processes where accurate control of temperature is important.

In connection with the company's program to bring a more efficient fuel to Latin America, Mrs. Garciela Friedrich, of Bogota, recently visited the United States to study latest methods of cooking and newly designed equipment in which propane is used. The company, of which she is director of home service, Cia. Colombian de Gas, S.A., is jointly owned by Tropical Oil Co., a Jersey Standard affiliate, and Colombian business men and was formed to distribute L.P.G. throughout Colombia.

Venezuelan Daily Production Shows Decline in May

Venezuelan daily crude-oil production dropped to 1,127,992 bbl. for May as compared with an April daily average of 1,143,333 bbl., according to the Venezuelan Bureau of Mines and Oil.

Tia Juana field accounted for a major portion of the decrease with a May production of 164,259 bbl. per day as compared with 178,095 bbl. for April. The six major producing fields of the country in May had the following monthly production:

	Bbl.
Lagunillas	9,288,701
Tia Juana	5,092,050
Bachaquero	2,679,484
Guara	2,334,755
Cabimas	2,187,045
La Paz	2,057,630

Creole Petroleum Corp. continued as the country's leading producer with a May production of 18,180,105 bbl. Other major companies and their production in barrels were: Venezuelan Oil Concessions, Ltd., 7,373,684; Mene Grande Oil Co., 5,406,276; and Caribbean Petroleum Co., 1,858,311.

Yemen Prince to Discuss Mineral Exploration Work

Prince Saif Al-Islam Abdullah of Yemen will contact American companies in a forthcoming tour of the Middle West to discuss the possibility of mineral exploration in his kingdom.

United States officials in Washington stated that the question of concessions has not been discussed as yet because the prince is interested first in determining what minerals, including oil, exist in Yemen, which lies in the southwest corner of the Arabian Peninsula.

Turkey Awaits Report on Resources Development

ALTHOUGH a recent dispatch from Turkey states that the government in Ankara is reluctant to grant oil concessions to private companies, it is considered likely that any final decision reached by the Turkish Government will not be made until after Max W. Thornburg, foreign oil consultant, has published his findings on the economic survey of Turkey, a survey which is in its final stages.

The Turkish Government is not expected to close the door completely until there is some indication of what might be the best means of developing Turkey's natural resources; that is, whether by private or governmental means.

Thornburg, who is conducting the economic survey of that country's economic resources, emphasied before leaving the United States early this year that no particular emphasis would be placed on petroleum, but that the possibilities of oil development in Turkey would be considered on an equal basis with other natural resources. Thornburg's findings will be published by the Twentieth Century Fund, a nonprofit institute for scientific research, probably within the next few months.

Government sources in Ankara indicate that several United States oil companies sought concessions in Turkey. The famed Chester concession, granted by the former sultan, was declared null and void more than 15 years ago, and since then the only exploratory and drilling operations have been carried on, respectively, by United Geophysical Co. and Exploration Drilling Co. (E. J. Brantly), for the Turkish Government.

Soviet Failure to Pay for Equipment Protested

Failure of Russia to pay for 7,000 tons of oil equipment owned by a Romanian subsidiary of Standard Oil Co. (N. J.) and removed from Romania by Soviet forces has been protested by the Department of State.

State Department officials said the property was valued at about $1,000,000 and was taken from Romania late in 1944. They said a note has been presented to the Russian foreign office by the American Embassy in Moscow protesting refusal of Russian members of the American-Soviet Commission to agree on a settlement

Bahrein Asphalt Plant Completion Delayed

Bahrein Petroleum Co., Ltd.'s modern asphalt plant, originally scheduled for completion by July, is now not expected to be finished before October or November. Delay in obtaining the necessary construction materials held up construction.

When completed, approximately 1,125 drums will be filled daily. The plant on Bahrein Island in the Persian Gulf is so designed that its capacity can be doubled or tripled as needed.

Crude-oil production on Bahrein is now up to 25,000 bbl. daily and presumably will continue at this figure for the remainder of this year. By November, 12 additional wells will have been repaired or redrilled.

Bahrein's aviation-gasoline plant, which was constructed as a war measure, with a daily capacity of 6,000 bbl., is now idle. Facilities, however, are in a standby condition.

Co-ops Present Arguments For U. N. World Oil Control

In presenting its case for world oil control before the United Nations, via a 5,000-word document now circulating among U. N. members, International Cooperative Alliance and affiliated Cooperative Petroleum Association charges all existing private oil companies, whether with foreign affiliations or not, as representing cartels in one form or other.

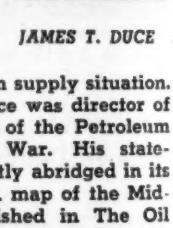
In two separate cases the document charges oil companies in Europe of having conspired in such a manner as to prevent Russia from selling her oil surplus. The document also states oil company profits have been strikingly high in foreign fields.

"From the very start of the pioneering period," co-ops hold the only answer to orderly development of world oil resources "to check abuses of power by monopolistic associations" is offered by consumers cooperative organizations. The co-ops would like to see U. N. wield control over Middle East oil fields first and thus make it possible for co-ops to obtain crude oil and presumably products there on equal terms with companies which now control that area's production and refining operations.

Foreign Oil Operations Marked by Uncertainties and Hidden Costs

by James Terry Duce

International
WORLD-WIDE OIL DEVELOPMENTS



JAMES T. DUCE

This statement was made July 16 before the national resources economic subcommittee of the Senate public lands committee by James Terry Duce, vice president of Arabian American Oil Co. in connection with the subcommittee's investigation of the petroleum supply situation. During the war, Duce was director of the foreign division of the Petroleum Administration for War. His statement has been slightly abridged in its presentation here. A map of the Middle East was published in The Oil and Gas Journal's issue of July 19, page 47.

YOU have already received a great deal of testimony regarding the situation in the United States, and there is nothing that I can add to the voices of the experts on the subject who have already been before you. I shall confine my remarks to the oil resources of the Near East, particularly those of Saudi Arabia and their flow into world trade.

In general, it might be remarked that a barrel of oil produced anywhere in the world affects every other barrel of oil either directly or indirectly. For instance, during the war period, the increase of naval operations in the Aleutians caused us to press for the increase in the runnings at Abadan in Iran for increased Navy activity in the North Pacific meant that more oil had to be drawn from the California Coast. This in turn cut off some of the California supplies going to MacArthur in New Zealand and Australia and we had to substitute oil brought through the Panama Canal from the Caribbean. This brought about a decrease of oil available in the European and the Mediterranean theaters and caused us to require increased amounts of oil from the Middle East. This kind of a process is even more effective in times of peace than in times of war for in peacetime all the sea lanes are open, so that if there are sufficient tankers, supplies can get to critical points promptly.

During a war period too, oil from certain specific areas may be of great strategic value for a short time, as, for instance, during 1942 for some months the most important oil production in the world was that from a small field, Ras Gharib, on the Red Sea Coast, in that it contributed so much to the support of the British Army defending Egypt. The production from the Persian Gulf during the war enabled us to support naval units in the Indian Ocean and was an important factor in holding the Japanese out of India.

One cannot predict what strategic situations may arise in the future, but I observe that the strategic center upon which the last two wars have turned has been the Middle East, particularly Egypt, and that peculiarly sensitive nerve of international communications, the Suez Canal.

Air view of Arabian American Oil Co.'s Ras Tanura refinery with the marine loading terminal in the background

Size of the Middle East

The great oil resources of the Middle East lie in a basin which extends from the Turkish boundary just north of the town of Mosul to the boundaries of southern Arabia. It has an area approximately as great as that of our great plains. To illustrate, if we impose a map of the Middle East on a map of the United States on a similar scale, the Turkish frontier would lie somewhere near Winnipeg while the south end of the basin would extend to Houston. It is approximately 500 miles wide. The oil occurs in this great area under two very different types of geological conditions for along the foothills of the Zagros, east of the Tigris, there are immense steep folds, often faulted, where early and middle Tertiary horizons have yielded some of the

world's greatest oil fields. They include such oil concentrations as Kirkuk in Iraq. Masjid-i-Sulaiman, Gach Saran, White Oil Springs, and Haft Kel in Iran.

If we now turn to the western side of the Mesopotamian Plain, we find a geological province which extends from the Turkish frontier to the head of the Persian Gulf and on into southern Arabia. Here there is an entirely different type of structure. The folds are gentle arches of huge size, the production comes from older rocks of Cretaceous and Jurassic age and there have also been developed some of the greatest oil fields, including one probably the largest known field in the world today, Burghan, in the Sheikhdom of Kuweit. In Arabia, we have four fields in this zone, Dammam, Abqaiq, Qatif, and Abu Hadriya, and on the Island of Bahrein, the Bahrein Petroleum Co. has found another one. There is also Dukhan field discovered by an Iraq Petroleum Co. affiliate on the Peninsula of Qatar and about to be commercially developed. In this same area, and also in Iran, occur great numbers of salt domes and I think that ultimately production will be found around these domes.

Further Discoveries

We do not have, at the present time, any very good idea as to what future reserves may be found in the whole basin. Joseph E. Pogue, of the Chase National Bank, has guessed that they may exceed 150,000,000,000 bbl. Pogue was simply making a guess as to the order of the ultimate reserves of the region, and he would be the first to admit it was only a guess for we are only beginning to know the story of the geology. From our early studies, we believed the geology of Saudi Arabia to be simple, but as we obtain knowledge, our idea of its complexity increases. We believe, nevertheless, that we can continue to discover oil in substantial quantities in Saudi Arabia for a long time to come.

The prospects of this area are, therefore, very great. The only other area in the world of equal or greater prospect is Russia and of that we know not too much at the present time. The area in which we believe oil will occur in Russia is immense. The richest deposits of oil ever found are probably those on the Apsheron Peninsula, whose center is the town of Baku. Formations which can yield oil extend widely over the central Russian plains into the Arctic circle. There are great areas in Siberia which deserve prospecting, and the great Turkoman-Caspian basin which extends from the shores of the Pruth to the storied cities of Tashkent and Samarkand will undoubtedly continue to be one of the world's greatest sources of petroleum. All that is needed to supply Russia from its home resources for generations to come is the sedulous application of those methods of which the American has proved to be the past master.

Present Production

The production of the Middle East grew rapidly during the war period. Because of the wide spacing of the wells and the nature of the geological formations, it was possible to draw oil rapidly from these fields. The well spacing is large, formations are sufficiently creviced so that the oil flows rapidly to the well bore, and high potentials can be maintained for long periods of time without damage. The Arabian fields are at present producing approximately 250,000 bbl. daily, contrasted with the 12,000-bbl. daily production at the time of our entrance into the war. On the Island of Bahrein, production is about 25,000 bbl. daily, so that the total production for the two operations is approximately 275,000 bbl. daily. About 240,000 bbl. daily of this oil is refined in the Persian Gulf, 110,000 bbl. daily in the Arabian American plant at Ras Tanura and 130,000 bbl. daily at Bahrein, leaving 35,000 bbl. daily of crude for shipment offshore, which latter oil, at the present time, goes to various plants in the Mediterranean and South American areas. Of the capacity of the two refineries nearly one-third of the oil after refining goes to the United States Navy.

When the war started the capacity of the Bahrein plant was approximately 35,000 bbl. daily, and the Arabian American Oil Co.. had a small refinery with the capacity of 3,000 bbl. daily which had been out of production for a considerable period of time. During the war, the Bahrein company increased its capacity up to 125,000 bbl. daily, including a 100-octane plant. At the instance of the Joint Chiefs of Staff, the Arabian American Oil Co. planned the construction of a 100,000-bbl. daily refinery on the mainland at Ras Tanura. However, after a letter of intent had been issued by the Petroleum Administrator for War, this letter was withdrawn, and the company undertook under its own authority and with its own funds the construction of a 50,000 bbl. daily plant. This was completed shortly after V-J Day at a cost of more than $50,000,000 and has since been occupied largely in supplying the Navy with fuel oil, diesel oil, and gasoline. Without the supplies from this plant, it is doubtful if the Navy could have operated its flying carpet which brought so many of our troops home from the war theaters in the Near and Far East. This plant has run at over capacity since it opened. We are proud of its record.

Your committee has indicated that they are interested in the cost of oil from this area. I will confess that I do not know what to tell you about the cost of oil and I would like to explain why. In the first place, it is

impossible to determine absolutely the cost of producing oil from any oil field. The accurate final cost of a barrel of oil from a field can only be determined after one has produced all the oil from the oil field. Costs vary from field to field and from well to well in the same field and from time to time. In the second place, I might add here, that a good deal of misinformation regarding cost of producing oil abroad has been spread about by people who never tried to produce it in foreign countries. I do not know of a single place in the world where, under the same physical conditions, it costs less to drill a well than in the United States. Wells which cost us $250,000-$300,000 in Saudi Arabia could be drilled for half that amount in the United States. For reasons that I will explain in a moment, it is necessary to use many Americans and their services cost much more abroad than at home. Indeed the cost of American labor in Saudi Arabia is double that at home.

Labor Costs

Let me tell you of some of the factors. It costs us, for instance, about $25,000 to build a house for a man and his family on the job. In addition to that, we provide schools, hospitals, medical service, transportation half way around the world—backwards and forwards, double the vacation allowance in the United States, plus travel time. Single men are provided room and board and married men, living allowances. By the way, housing for veterans is one of our problems too! As to the native labor which has been referred to by some as cheap labor, anybody who has dealt with untrained native people, know that they do not make cheap labor—they are expensive labor. While the wage rates are comparatively low, the amount of labor output is such that on the whole it would pay better to import skilled American labor for everything but the smallest and most simple tasks. As a matter of fact, however, we recognize our obligation in operating abroad to employ as much native labor as possible and train it until it can take up a large portion of the work of oil field operation and share as largely in the pay rewards as is possible. Trained, the Saudi Arab is an excellent workman.

In addition, the food, clothing, machinery, equipment, and supplies of all kinds which we use in Saudi Arabia have to be imported from abroad.

In addition to the direct costs such as those just mentioned, you must recall that in a country like Saudi

(Continued on page 327)

Governors' Conference Calls for Return of Tidelands

ACTION by Congress returning title to offshore submerged lands to the states gained powerful support July 16 when the Governors Conference in Salt Lake City voted a resolution in favor of quitclaim legislation.

The resolution was adopted after Gov. Beauford Jester of Texas made a strong plea for endorsement declaring that the new theory of federal power enunciated in the Supreme Court's decision "is a serious threat to the rights and property of every state."

In his talk before the governors, Jester pointed out the implications of the far-reaching decision of June 23 holding that title to lands beyond the low-tide mark belongs to the federal Government *(The Oil and Gas Journal, June 28, page 74)*.

"This case," Jester said, "will, no doubt, become a potent weapon for proponents of the nationalization of the entire oil and gas industry as well as other industries, the portent of whose business is tied in with our national security and might become 'the subject of international dispute and settlement.'"

The Supreme Court's decision in the so-called tidelands case resulted from a suit brought by the United States attorney-general against the State of California. At issue immediately was the offshore belt along California's coast which has been extensively developed for oil production. Federal officials are now arranging interim administration of their new property pending complete settlement after the Supreme Court enters a final decree September 15. Last year, while the case was pending, Congress passed legislation to confirm state title to submerged coastal lands but the bill was vetoed by President Truman on grounds the issue should be decided by the Supreme Court.

Texas Fears Claim

Texas, though not directly involved in the California case, fears that the federal Government will assert claim to its gulf coastal lands. Texas and Louisiana offshore areas are now the scene of wide-spread oil exploration, and many geologists believe important reserves will be found.

A prediction that the President will approve new legislation quitclaiming the submerged lands to the states was made last week in Austin, Tex., by Allan Shivers, Texas lieutenant governor. Returning from a trip to Washington, Shivers said he understood the President is "looking with favor upon signing such legislation." He added it is doubtful that a bill could be put through this session if Congress adjourns July 26 as scheduled.

The resolution passed by the Governors' Conference in Salt Lake City asked that Congress pass legislation that would acknowledge and affirm "ownership of submerged lands and resources to the respective states" in accordance with "long-recognized constitutional rights of the states." Jester offered a revised resolution after his original one met opposition because of its criticism of the Supreme Court.

In his talk at the conference, Jester who before his inauguration as governor was a member of the Texas Railroad Commission, declared the court's decision affects more than the offshore oil property in California. "The new legal theories of state-federal relations announced in U. S. vs. California is something that will haunt every sovereign state in the future if it is not nullified by appropriate congressional action," he said.

Previous Opinions Not Considered

After reviewing the legal and historical background of the case, Jester said: "But the Supreme Court did not consider the Pollard case or the 52 former Supreme Court opinions restating and following the same general rule or the 244 federal and state decisions (some of which involved exactly the same land off the California coast) or the 49 attorney general opinions or the 31 Department of Interior opinions as even persuasive authority in support of state ownership under the marginal sea. Instead, the court pronounced an entirely new legal theory of a paramount federal right to take oil and natural resources, without regard to whether the federal Government actually owns the soil from which such resources are to be taken. And in direct support of this new theory of superfederal rights and powers, the court cited no constitutional provision, statute, or former decision."

Jester was sharply critical of the court's finding that the federal Government rights to the area are paramount since it has the duty of conducting national defense and international relations. The court, in its opinion, said the United States "here asserts rights in two capacities transcending those of a mere property owner." This, Jester declared, 'is, so far as we have been able to find, the first American decision holding that any private or governmental agency has the right to take property and resources beneath the soil without lease or fee ownership, or without compensation to the true owner of the soil. . . ."

"I think that this new theory of federal power to take natural resources in the name of national defense and without compensation is a serious threat to the rights and property of every state. When and where will this superfederal power end? It was not one of the powers delegated by the states to the national Government. It is not a power that Congress has ever asserted. We learn of it for the first time in the Supreme Court's California decision ....

Situation Different

"In Texas we have always felt that we were secure in our ownership of coastal submerged lands because while a republic, the Texas Congress set our boundaries three marine leagues (10½ miles) out in the Gulf of Mexico. When Texas entered the Union in 1848, Congress agreed that all public lands would be retained by the state.

"Texas has never ceded any submerged lands to the federal Government. Revenue from leases on our rivers, bays, lakes, and gulf lands is dedicated exclusively to the public-school fund. This means millions of dollars to the public schools of our state, and it could mean millions of dollars to each of the inland states in which oil may be discovered beneath rivers and lakes. Although we retained our lands differently from other states, we are worried over the California decision because we fear that the Supreme Court may extend this federal power to take the resources from beneath our lands, regardless of ownership and with compensation.

"Fortunately, at various places in the California tidelands decision, the right of the Congress to recognize state ownership and quitclaim these lands and 'paramount' rights is affirmed. The matter is still a proper question for congressional action. In his veto last year, President Truman said he thought the question of ownership should be settled by the court. Since the court's decision was not based on ownership in the federal Government but upon this new theory of 'paramount federal rights,' the original and vital question still remains for Congress to decide.

"The marginal sea surrounding our nation out to the 3-mile limit includes 65,000 sq. miles of land, an area as large as all the five New England states combined. Transplanting the former control of the respective states over this great area to the federal Government would seem to be a drastic step toward further federalization of overcentralization of our government."

Repeal of Federal Automotive Taxes Urged by A.P.I.

ALL federal automotive excise taxes, including the 1½-cent per gallon tax on gasoline, should be repealed because they are a "great hardship on the already overtaxed motor-vehicle owners."

William R. Boyd, president of the American Petroleum Institute, made this statement last week in a statement filed with the House ways and means committee in Washington, The A.P.I. head listed five reasons why the federal Government's "emergency" automotive taxes should be abolished.

The A.P.I. thus joined the growing groups of organizations urging Congress to rescind the levies. Earlier this month, the National Highway Users Conference declared the federal taxes threaten the future of highway transportation and should be eliminated from any peacetime structure developed by Congress.

The federal Government now taxes eight different items involving highway users. Principal one of these is the gasoline tax which in 1946 brought in $413,953,324. Other federal collections and the 1946 return are: lubricating oil $73,442,151; transportation of oil by pipe line $15,174,591; automobile and motorcycles $111,920,862; trucks $41,718,660; tires, etc., $159,127,669; auto parts, accessories, $81,245,622, and motor vehicle use $848,531—total $898,431,411.

Unfair and Repressive

Boyd told the committee in his statement that the petroleum industry joins "wholeheartedly with other organizations and groups in urging repeal of all federal automotive excise taxes." He continued: "Congress can now assist and encourage industrial expansion by removing from the federal tax structure all unfair and repressive levies. The federal tax on gasoline is such a levy, and its repeal would promote business expansion and attract private capital into industries which depend in whole or in part on gasoline-consuming machines."

The following reasons for repeal of the taxes were cited:

1. The automobile owner is already overtaxed. Boyd pointed out special levies on vehicle owners took over $2,500,000,000 in 1946. "This large burden of taxation is obviously beyond the ability of the average citizen to pay in normal times, and if the widespread expansion of personal transportation is to be continued in this country, automotive taxes should be reduced," he said.

2. The federal taxes on gasoline are duplicating levies made by every state and some counties and cities. The average of all gasoline taxes is 4.7 cents per gallon and runs as high as 7 cents per gallon in some states, Boyd said.

3. Gasoline should not be taxed on the basis of a luxury since it has become a necessity to the economic life of the nation. The A.P.I. president said, in the opinion of most tax experts, to group gasoline in the luxury class, is "wholly erroneous and unjustified."

4. The federal gasoline tax fails to return any direct benefit to the highway users since it is not specified for highway development. "Rather," Boyd said, "the federal tax is a levy on a means of livelihood of those who earn their bread in the transportation industry."

5. The federal tax materially affects the general cost of living since it is reflected in consumer prices. "Motor transportation of vital commodities is," Boyd said, "in a great many instances, the sole means whereby these goods may be delivered to the consumers. . . . naturally, any excessive operational cost ultimately finds its way into the consumer's pocketbood and the housewife's budget."

Barge Capacity Reported Short on Mississippi

WASHINGTON.—Although oil-barge capacity has increased more than 10 per cent since July 1946 and towing power has shown a comparable gain, there is a substantial shortage of barge capacity at the present time on the Mississippi River, the barge transportation committee of the National Petroleum Council said in a report last week.

The report, released by Walter S. Hallanan, NPC chairman, was adopted at the council meeting July 10 in Washington. The committee said the shortage in barge capacity is due to the demand for long-haul barge movements of oil and oil products from the Gulf Coast area, which started in the summer of 1946 and has substantially increased this year.

The oil-barge and self-propelled barge equipment in the East Coast area and the New York Barge Canal and tanker fleets operating on the Great Lakes appear to be adequate for present industry requirements, although there is little or no surplus, the report said.

The NPC report on petroleum production and crude availability, which was expanded at the council meeting July 10, pointed out that the producing branch of the industry has had to search for pipe with as much vigor as it normally uses in looking for new oil pools. Yet, in spite of all difficulties, the industry is now producing more oil than it ever has, this report said.

If casing and line pipe were obtainable, it was the opinion of the committee that substantial quantities of oil would have been available.

Oil producers, both large and small, are doing a magnificient job in the face of shortages of materials and lack of transportation, either by rail or pipe line, and production availability inevitably suffers as a result of these shortages, it added.

House Approves Funds For OGD Operations

WASHINGTON.—An appropriation of $275,000 to operate the Oil and Gas Division during the current fiscal year was approved by the House in accepting the conference report on the Interior Department appropriation bill. Of this sum, $175,000 is earmarked for enforcing the Connally hot oil act and $100,000 for other OGD functions.

As the House passed the bill originally it contained only $124,000 for the Connally act and nothing for other OGD activities. The Senate raised the Connally funds to $169,340, and gave $155,390 for other work, a total of $324,730 for OGD. The final agreement thus gives more money for the Connally act than either House had approved originally, but less for the OGD Washington office than the Senate voted. However, the $100,000 is believed to be sufficient to keep OGD alive and provide a nucleus staff for coordinating and unifying government petroleum policies.

Reiter-Foster Acquires Harris County Interests

Acquisition of a half interest in the Lenoir Josey holdings in Joyce Richardson field in Harris County, Texas, by Reiter-Foster Oil Co., New York, has been disclosed. The purchase represents an interest in more than 1,400 acres on which are eight deep wells and a recycling plant.

The company is reportedly planning to drill a 10,000-ft. well in the near future to test a sand which has proved prolific production in nearby fields.

WASHINGTON WATCHING

BY HENRY D. RALPH

Rizley Bill Background

WASHINGTON.—Shelving the Rizley bill is a major victory for the Federal Power Commission, which has been fighting with its back to the wall against a double-barreled attempt to curtail its jurisdiction.

The heaviest attack came from electric utilities which complain that FPC has gone beyond the intent of Congress in requiring federal licenses to generate hydroelectric power on what are claimed to be intrastate or nonnavigable streams. Early in the present session of Congress sponsors of restrictive amendments to the Federal Power Act tried to make a deal with the natural-gas industry to remedy both complaints in a single bill. Backers of the Rizley bill refused, but they have now been caught in the backwash of the power fight.

Many politicians and publicists have long been suspicious of the "electric power lobby," so this bill was under attack from the first whereas the Rizley bill attracted relatively little public attention. FPC was accused of "feeding propaganda" to "pet columnists" who were denouncing the power bills. It may or may not be a coincidence that lately some of these same writers have been attacking the Natural Gas Act amendments, quoting figures on how much money FPC has saved consumers by ordering reductions in gas rates, citing the earnings of pipe-line companies, and implying that the Rizley bill would end all effective rate regulation.

Plausible Argument

This line of argument undoubtedly influenced a good many members of Congress, for FPC has a plausible argument that the Rizley bill goes too far beyond the admittedly immediate problem of the independent producer of natural gas in that it might remove regulation from pipe-line companies which produce their own gas. Whether completely correct or not, this sort of argument carries weight with people accustomed to think of all utilities as gouging monopolies.

Another argument against the bill which apparently helped to kill it was the presence of the inexplicable "common carrier" provision, which would give the Interstate Commerce Commission jurisdiction over a gas pipe line operated purely as a common carrier of gas for others. The gas industry did not ask for this and did not defend it, but it created the impression that a pipe line could "shop around" between FPC and ICC for the least amount of regulation.

Toward a Compromise

STRATEGY for securing amendments to the Natural Gas Act at the next session of Congress depends largely on developments in the interim.

The Supreme Court has said that the Federal Power Commission has jurisdiction to regulate any production and gathering of natural gas which eventually gets into the stream of interstate commerce and to apply public utility rate-making formulas to its price. Oil and gas producers say this is intolerable, and FPC pretty much agrees, at least as concerns arms'-length sales by producers not affiliated with pipe-line companies.

The commission has proposed to exempt such business from its jurisdiction by means of an administrative rule. The industry relies that this is all right in so far as it goes but that self-abnegation by FPC is not sufficient assurance so long as the law stands as the Supreme Court interpreted it. Undoubtedly FPC and the industry could get together on legislation exempting independent producers which would take care of about 90 per cent of the objections to the present act.

Next Biggest Controversy

The next biggest controversy is determination of the field price where a pipe-line company produces from its own reserves, purchases from an affiliate, or is in position to dictate the price. This is not such a simple problem. FPC objects to the industry's proposal in the Rizley bill but has not yet offered an alternative. However, it promises to make a recommendation within a few months. If this should provide a basis for a reasonable compromise, the chances of getting legislation next year will be greatly improved.

The highly controversial "end use" section has already been dropped from the Rizley bill on the ground that FPC so far has not actually put into effect its suspected desire to dictate the uses to which a consumer may put his gas. Other remaining provisions of the Rizley bill are not so highly important to a large part of the industry, and clarifying legislation acceptable to the Senate probably could be worked out if an earnest attempt were made.

At the moment FPC has the upper hand, politically. The public is highly sensitive to charges that consumers' gas rates will go up if pipe-line companies can themselves fix the price at which gas enters their lines, and not much weight is given the answer that such increase will be only nominal or that the price of everything else has gone up and gas is already too cheap.

Viewing the situation realistically, it would appear that the gas industry may have to compromise with FPC to a considerable extent to get necessary amendments to the Natural Gas Act past the Senate and the White House at the next session of Congress.

Embargo Agitation

THE new and tightened export control law just passed by Congress is not tight enough for many members of Congress who are making last-minute attempts to embargo all exports of petroleum and of steel needed by the oil industry.

Almost every day some member of the House or Senate makes a speech or issues a statement denouncing exports, particularly to Russia, as being the cause of the threatened oil shortage in this country. During the past couple of weeks several committees have asked Commerce Department and other witnesses for statistics on oil and pipe exports and have been highly critical of any foreign shipments of either commodity.

Most persistent is Chairman Albert F. Weichel of the House merchant marine committee, who is pressing for action on his bill to embargo all exports of petroleum or petroleum products. Last week he catechized officials of a number of oil pipe-line companies as to the extent to which their lines are used to move oil destined for export, and then held 2 days of closed sessions with government officials.

The administration's position is, of course, that a certain volume of exports is necessary to fulfill foreign policy commitments, to maintain a balance in our foreign trade, and to continue the flow of certain essential imports. An outright embargo on oil exports, for example, very likely would bring retaliation from other nations on whom we depend for imports of commodities not produced here.

Weichel finally modified his proposal to allow exports of oil only if about half the Cabinet certifies that shipments will not impair national defense in any way nor create any possible domestic civilian shortage. This would be about the same as a flat embargo, but there appeared little chance that any such measure would get through Congress during the closing days of the session.

Controlling Pipe Exports

CLOSE control of the exports of oil-industry pipe and tubular goods was one of the first steps taken by the Commerce Department under the authority of the Second Decontrol Act of 1947 which became law July 16, continuing import and export controls until February 29, 1948.

The department immediately began a thorough reexamination of the steel export situation to see what is needed to protect the domestic supply, but without waiting the results of this study it withdrew steel plate and steel pipe and tubing from the consolidated license procedure and is now requiring an individual license for each shipment, thus securing control over the country of destination and end use of the product. Seamless pipe and tubing, which was recently returned to control, is on the same individual license basis. The current policy is to approve exports of pipe only for essential petroleum uses abroad. The third-quarter quotas for exports of steel pipe have not yet been announced, but officials say they are being subjected to the severest scrutiny of the urgency of foreign need and the severity of domestic requirements.

As required by the new law, the department is basing its decisions on the recommendations of an export policy committee composed of representatives of many governmental agencies.

New "Tideland" Arguments

THE State of California has filed a petition with the Supreme Court for rehearing and reconsideration of the decision upholding the federal Government's claims to the bed of the marginal sea between the low tide mark and the international boundary.

It may be a futile gesture in view of the fact that this decision was by a majority of 6 to 2, but the state has dug up some new legal evidence and additional arguments which it claims were overlooked by the court. It also says that the court failed to consider the implications of its decision and its far-reaching effects on thousands of persons and on subsidiary issues.

Among the points overlooked by the majority opinion, says the state, are these: prior decisions that the federal Government's powers over international affairs and national defense do not carry with them any cession of territory or proprietary ownership rights; a unanimous Supreme Court decision in 1908 that land under the Great Lakes forming the international boundary with Canada belongs to the states rather than the federal Government; the established rule that territory may be annexed only by Congress and not by executive officials; scores of unchallenged state court decisions holding that the states own the ocean bed out to the 3-mile limit; the legal rule that property acquired and used in good faith and without challenge established a good title; the absence of constitutional, statutory, or factual basis for distinguishing between ownership of the open ocean and the beds of bays and harbors.

Where Reasoning Could Lead

The reasoning that the federal Government needs the oil involved for national defense could lead to the doctrine that the Government may appropriate any land, mineral, or other thing it needs without payment of compensation, says the petition, and concludes:

"The majority opinion, if allowed to stand, will deprive every coastal state of enormous areas of property and of valuable property rights which have long been held and occupied by them. . . . In a word, there is absolutely nothing upon which the federal claim in this case is or can be predicated except the unsupported declaration of the majority of the court that national power gives the federal Government the right to appropriate these properties to its own use, a proposition which as we have shown is contrary to all past decisions on the subject. If this decision should stand, no one today could foretell the extent to which future federal administrations may go in asserting the right to expropriate private property and property rights on the basis of the vague concept of 'national power' which is relied upon therein."

Excise Tax Repeal

A GREAT weight of arguments for repeal of the federal excise taxes on gasoline, lubricating oil, automobiles, trucks, parts and tires has been presented to the House ways and means committee during the past couple of weeks by a group of trade associations including the American Petroleum Institute, American Trucking Associations, National Highway Users Conference, and others.

The committee has been holding hearings on the general subject of revising the federal Government's revenue structure, but has no specific bill before it. Further hearings will be held in the fall, covering taxation of cooperatives and other subjects, and the committee plans to draft a comprehensive tax revision measure early in the next session of Congress. So far the committee has not taken a formal position as to the percentage of revenue which should be obtained from excise taxes, though many individual members are on record as favoring repeal or reduction of those which were imposed for war purposes.

Penn Grade Group Renews Research Agreements

The Pennsylvania Grade Crude Oil Association has extended to June 30, 1948, its cooperative research agreements with Battelle Memorial Institute, Columbus, Ohio, and the U. S. Bureau of Mines.

The agreement with Battelle Institute calls for use of the institute's services and research facilities in connection with corrosion studies of oilfield equipment. Field tests employing Battelle's recommendations to reduce corrosion currently are under way at wells in the Oil City, Pa., area.

The association entered an agreement February 1, 1945, with the Bureau of Mines and periodically has renewed it, contributing funds to assist the federal agency's research in secondary recovery of oil, particularly studies of oil well flowing by means of energy within injected gas.

Both research projects were adopted with the aim of meeting needs of oil operators in the Kane-Butler, Pa., area where air and gas frequently are employed as repressuring agents to drive oil to the producing wells.

Pan American Buys 78 Oil, 12 Gas Wells in Texas

Pan American Production Co., subsidiary of Standard Oil Co. of Indiana, has purchased all the producing interests of Fred W. Shield, San Antonio, in 12 Southwest Texas fields and in Goldsmith pool, Ector County, Texas.

E. R. Turner, vice president, said the properties bought from Shield, who is president of the Texas Mid-Continent Oil and Gas Association, include 78 oil wells and 12 gas wells on 28 leases.

Pan American officials said the purchase price was "slightly in excess of $5,000,000." Interests in some of the properties owned by Joseph S. and W. C. Morris, also of San Antonio, were included in the deal.

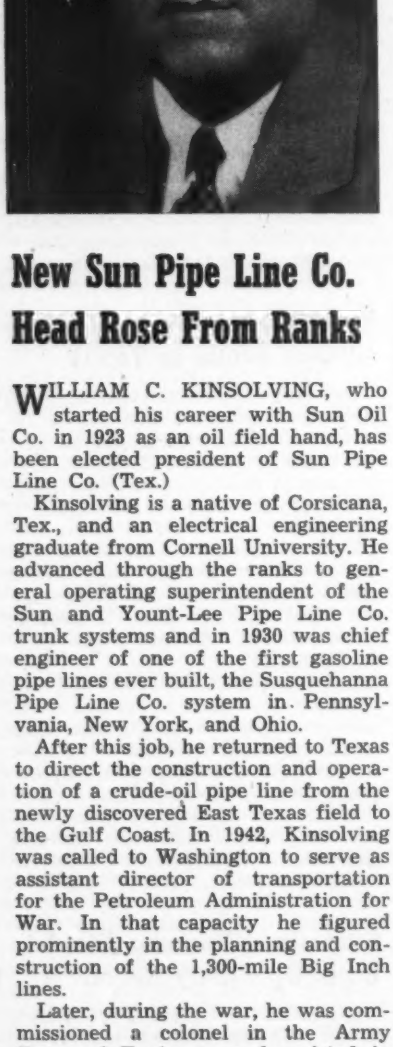
Major part of the purchased production is in Tom O'Connor, Refugio, Shield, and Tulsita-Wilcox pools in Southwest Texas.

Stanolind Wewoka District Runs Up Safety Record

Stanolind Oil & Gas Co. employes in the Wewoka (Okla.) district recently held a picnic to celebrate the completion of 1,500,000 man-hours of work without a lost-time accident.

C. D. Kerr, of Stanolind's division office, presented the workers with the American Petroleum Institute safety award and the Holmes Foundation award. D. H. Grall, district superintendent, accepted the awards on behalf of the employes.

PERSONALS



New Sun Pipe Line Co. Head Rose From Ranks

WILLIAM C. KINSOLVING, who started his career with Sun Oil Co. in 1923 as an oil field hand, has been elected president of Sun Pipe Line Co. (Tex.)

Kinsolving is a native of Corsicana, Tex., and an electrical engineering graduate from Cornell University. He advanced through the ranks to general operating superintendent of the Sun and Yount-Lee Pipe Line Co. trunk systems and in 1930 was chief engineer of one of the first gasoline pipe lines ever built, the Susquehanna Pipe Line Co. system in Pennsylvania, New York, and Ohio.

After this job, he returned to Texas to direct the construction and operation of a crude-oil pipe line from the newly discovered East Texas field to the Gulf Coast. In 1942, Kinsolving was called to Washington to serve as assistant director of transportation for the Petroleum Administration for War. In that capacity he figured prominently in the planning and construction of the 1,300-mile Big Inch lines.

Later, during the war, he was commissioned a colonel in the Army Corps of Engineers and assisted in the construction of the China-Burma-India pipe line. Upon completion of war service, he returned to Sun as manager of all pipe-line operations and held this position until his recent election as president. He succeeds John G. Pew who retired as head of the pipe-line company but continues as vice president in charge of production for Sun Oil Co. in Philadelphia.

F. Hill Sanders has been elected vice president, general manager and a director of Sun Pipe Line Co. (Tex.) and **Sanford E. Ogle** has been elected vice president and director. In the same company, **Everett L. Meley** has been appointed superintendent of storage and delivery facilities for the Southwest.

Donald P. Goodall has been appointed acting chairman of the Petroleum and Natural Gas Conservation Board of Alberta, and **Ross M. Moffat,** an officer of the board, has been named a member.

Warren K. Lewis, Massachusetts Institute of Technology professor, will receive the Priestley Medal for distinguished service to chemistry at the 112th national meeting of the American Chemical Society in New York September 15-19. Lewis, a member of the M.I.T. faculty since 1910, has been a leader in the application of chemical and chemical engineering principles to the production and refining of petroleum.

E. S. Armstrong has been promoted from head roustabout to farm boss in Hugoton field for Cities Service Oil Co.

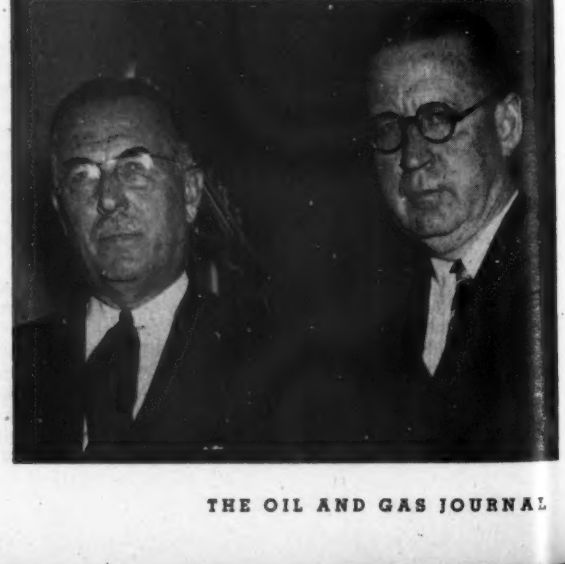
Hilton S. Bragg, an assistant superintendent of Shell Oil Co., Inc., has been installed as president of the Houston Central Lions Club.

D. S. SMITH

D. J. Smith has been elected president of Pan American Petroleum & Transport Co., and **C. H. Wagner** president of its affiliate, American Oil Co. E. G. McKeever, who died July 9, formerly was head of both organizations. Smith joined Standard Oil Co. (Ind.), parent company of Pan American, in 1916 after graduating from the University of Illinois with a bachelor of science degree. He has served as director and first vice president of Pan American Petroleum and president of Pan American Refining Corp. and several subsidiaries since 1944. Wagner, who also becomes president of Lord Baltimore Filling Stations, Inc., and Mexican Petroleum Corp., subsidiaries of American, joined Standard Oil Co. (Ind.) in 1916. Since 1945 he has served as vice president and general manager as well as a director of the three corporations he now heads.

H. F. King, Continental Oil Co. scout at Oklahoma City, has been transferred to the California division with headquarters in Los Angeles. King is a former president of the National Oil Scouts and Landmen's Association and recently organized the Oklahoma City Landmen's Association.

William H. Millhiser, vice president in charge of refining, Waverly Oil Works Co., was elected to the board of directors at the company's recent annual meeting in Pittsburgh.



Arriving last week in New York on the Queen Elizabeth were Chester F. Smith, vice president of Standard Oil Co. (N. J.), and Stewart P. Coleman, a director of the company. They were among the officials of Jersey Standard and affiliated companies who met in Paris to review the status of company operations and plans. The meeting was the first held by the coordinating group in Europe since before the war. (International News photo)

Dr. **R. N. Giles,** superintendent of technical service in the Whiting, Ind., laboratories of Standard Oil Co. (Ind.), has been promoted to director of technical service with headquarters in Chicago. Giles joined the company in 1930 after graduate work at Ohio State University. **Dr. C. R. Harte,** assistant superintendent of technical service at Whiting, succeeds Giles. Harte joined the company in 1936, after graduate work at the University of Michigan and several years of experience in industry. **W. F. Meehan,** a group leader, was advanced to fill the post vacated by Harte. Meehan became associated with the company in 1942 following graduation from the University of Detroit. **R. S. Daniel** succeeds Meehan.

DR. R. N. GILES

C. R. HARTE

W. F. MEEHAN

Other recent promotions in the Whiting laboratories include: **E. B. Tucker,** to section leader, research analytical section; **H. M. Grubb** and **W. L. Rittschof,** to group leaders, research analytical section; **F. W. Porsche,** to foreman, gas-analysis laboratories; **G. W. Flint,** to section leader, specialties; **C. E. Adams,** to section leader, exploratory research on chemical products; and **E. J. Campau, A. W. Lindert, D. E. Burney, Phillip Hill, W. R. Hertwig,** and **Moses Gordon,** to group leaders. **Michael Dufinecz** has been appointed patent advisor assisting **J. C. Stuffer.**

W. A. Bennett has become superintendent, Wyco Pipe Line Co., with headquarters at Denver. He formerly was acting district superintendent, Northwest products pipe-line system, Standard Oil Co. (Ind.)

Sidney A. Swensrud, executive vice president and director, Gulf Oil Corp., Philadelphia, and **Joe H. Russell,** vice president, Houston, headed a party of Gulf officials from Houston who visited Fort Worth and West Texas points on an inspection tour of company properties. Before returning to Houston, Swensrud was guest of honor at Gulf's annual picnic July 19 at Rodessa, Tex., which attracted some 4,000 employes of the West Texas district. **F. J. Adams,** general agent, and **Hugh M. Craig,** assistant to general agent, headed a group of 25 engineers and department heads attending the picnic from Fort Worth.

D. H. Caldwell, in charge of surface geology for Sun Oil Co.'s Dallas division, has transferred his headquarters from San Antonio to San Angelo, Tex., where Sun is expanding its staff in anticipation of extensive exploration on the east side of the Permian basin as well as continued development of its Coke County field. **W. Henry Conkling** succeeds Caldwell at San Antonio. **Lyle H. Brown** has been transferred from El Paso, to become assistant to Caldwell, and **D. T. Whitten** will move to San Angelo from Midland, Tex., to assume charge of the development of Jameson field.

C. B. Williams has been promoted from pipe-line engineer to assistant chief engineer, pipe-line department, Standard Oil Co. (Ind.)

John H. Kelsey has been appointed manager of the newly established district land and geological offices of Southern Minerals Corp. in Midland, Tex. The appointment is effective August 1. Kelsey joined Prairie Oil & Gas Co. in 1929 and has been with the Sinclair group 18 years. Since May 1946 he has been division land manager at Albuquerque, N. M. **Ellis H. Scobey,** formerly with Bay Petroleum Corp., is district geologist for the Midland area.

Clifford Mohr, Hoover, Curtice & Ruby, geologist in Punta Arenas, Chile, who for the last 4½ years has been conducting exploratory work for Corporación de Fomento, of the Chilean Government, in the Tierra del Fuego area, is now in the United States for a 4-month vacation. Mohr directed the operations which resulted in the discovery of oil in Spring Hill, Tierra del Fuego. He is now awaiting a new assignment by his company.

R. C. Cooper, division geologist for Sinclair Oil Co., with headquarters in Evansville, Ind., has been made manager of the land and geological office of the tristate district succeeding **A. H. Llwyd,** who has been transferred to the Albuquerque division.

Edward A. Koester, formerly vice president of Darby & Bothwell, Inc., Wichita, has resigned and will engage in geological consulting work. Koester is widely known among geologists. having just finished serving two terms as secretary-treasurer of the American Association of Petroleum Geologists.

William J. Kerns has become technical assistant to the head of alcohol operations in the chemical-products department of the Bayway (N. J.) refinery, Standard Oil Co. (N. J.) In the same plant, **Wilmer B. Laufman III** was appointed unit foreman in charge of alcohol-manufacturing operations, and **Patrick J. Dowling** has become a foreman.

Vaughn H. Stoughton, engineer for Arabian American Oil Co., is returning to Saudi Arabia after a 2-month vacation at his Oil City, Pa., home.

J. Marston Linehan has been elected president of Mid-Continent Pipe Line Co. to succeed **Jacob France,** who becomes chairman of the board. France also is chairman of the board of Mid-Continent Petroleum Corp. Linehan, formerly vice president and general manager, joined Mid-Continent Pipe Line Co. in 1933 as superintendent of the southern division, later becoming assistant superintendent and general superintendent. He was named vice president in 1944.

J. M. LINEHAN

Robert B. Curran, vice president and director, Carter Oil Co., will move his headquarters from Billings to Denver on or after September 1. Curran heads the northwestern division of the company. **T. R. Corbett,** manager of refining, and **C. W. Menke,** manager of marketing, will remain at Billings. Among the personnel moving to Denver with Curran are **Ray D. Sloan,** manager of exploration, and **C. L. Cooksey,** manager of production.

P. M. Broach, Standard Oil Purchasing Co., Tulsa, has been transferred to the executive department of the company as administrative assistant. **H. A. Weatherby** has been named chief scout, and **L. D. Graham,** geologist.

D. A. Hulcy, president of Lone Star Gas Co., Dallas, has been named chairman of the natural resources de-

PERSONALS

partment committee of the U. S. Chamber of Commerce. Membership of the committee includes: **Merle Becker,** executive vice president, W. C. McBride, Inc., St. Louis; **L. F. McCollum,** Standard Oil Co. (N. J.), New York; and **Albert C. Mattei,** president, Honolulu Oil Corp., San Francisco.

H. G. Davis, general manager of Colombian Gulf Oil Co., is now in the United States for a 3-month vacation. **Charles H. Dresbach** has temporarily taken over Davis' duties.

Paul Rogers has been appointed assistant field production supervisor for Lone Star Gas Co. and transferred to Dallas from Duncan, Okla., where he was district production engineer.

Shifts

George Stanford, superintendent, Rocky Mountain Drilling Co., Bakersfield to Coalinga; **Milan G. Arthur,** engineer, Union Oil Co. of California, Santa Fe Springs, to Whittier, Calif.; **J. C. Rector,** superintendent, Union Oil Co. of California, Santa Fe Springs, to Whittier, Calif.; **John E. Sherborne,** engineer, Union Oil Co. of California, Santa Fe Springs to Whittier, Calif.; **K. C. Vaughn,** superintendent, Union Oil Co. of California, Santa Fe Springs, to Whittier, Calif.; **G. R. Brown,** engineer, The Texas Co., Jal, N. M., to Wichita Falls, Tex.

G. A. Grimm, foreman, Seismograph Service Corp., Lovington, N. M., to Midland, Tex.; **Paul J. Williams,** engineer, Gulf Oil Corp., Crane to Iraan, Tex.; **E. L. Wells,** foreman, Continental Oil Co., Henderson, Tex., to Sulphur, Okla.; **O. L. Chenoweth, Jr.,** engineer, Gulf Oil Corp., Lamesa to Levelland, Tex.; **Herbert C. Wilson,** engineer, Standard Oil Co. of Texas, Plainview to Midland, Tex.; **Jack M. Fulkerson,** engineer, Comco Oil Service, Tomball, Tex., to LaFayette, La.; **Clyde R. Claus,** engineer, Magnolia Petroleum Co., Alice to Luling, Tex.

Robert A. Neath, engineer, Humble Oil & Refining Co., Corpus Christi to Encino, Tex.; **Joseph B. Jenkins,** engineer, Stanolind Oil & Gas Co., Fort Worth to Lubbock, Tex.; **A. W. Paine,** engineer, Sunray Oil Corp., Fort Worth to Odessa, Tex.; **A. G. Eberts,** foreman, The Texas Co., Galveston to Tyler, Tex.; **F. A. Jennings,** superintendent, Phillips Petroleum Co., Lubbock to Odessa, Tex.; **L. M. Wall,** superintendent, Helmerich & Payne, Inc., Odessa to Hobbs, N. M.

Reba B. Masterson, geologist, San Antonio, Tex., to Nederland, Colo.; **Curtis D. Sims,** engineer, Universal Oil Products Co., Tyler, Tex., to Shreveport; **James C. Gibson,** engineer, Gulf Oil Corp., Wickett to Crane, Tex.; **L. D. Griffin,** superintendent, N. H. Wheless Drilling Co., Columbia to Houma, La.; **James R. Bowen,** engineer, Shell Oil Co., Inc., Wood River, Ill., to Houston; **R. S. Vickers,** engineer, Standard Oil Co. (Ind.), Gary, Ind., to New York.

Robert B. McCulloch, geologist, Stanolind Oil & Gas Co., Craig to Denver, Colo.; **O. M. Ralph,** engineer, The California Co., Rangely, Colo., to Escalante, Utah; **J. F. Hodge,** engineer, Celanese Corp. of America, Pittsburg, Kans., to Dumas, Tex.; **A. D. Passmore,** foreman, Barnsdall Oil Co., Maud, Okla., to Oxford, Kans.

C. C. Chapman, engineer, Phillips Petroleum Co., Bartlesville, Okla., to Phillips, Tex.; **H. T. Hunter,** engineer, Stanolind Oil & Gas Co., Oklahoma City to Tulsa; **John H. Eppard,** engineer, Phillips Petroleum Co., Okmulgee to Tulsa; **L. Decker Dawson,** foreman, Republic Exploration Co., Fairview, Okla., to Plainview, Tex.; **Thomas W. Brinkley,** engineer, Carter Oil Co., Tulsa to Oklahoma City.

Charles A. Houston, engineer, Stanolind Oil & Gas Co., Tulsa to Zenith, Kans.; **Lawrence P. Spencer,** engineer, Tropical Oil Co., El Centro, Colombia, to Bogota, Colombia; **Robert S. Breitenstein,** geologist, Caracas to Maracaibo, Venezuela; **J. H. Sawyer,** geologist, Creole Petroleum Corp., Maracaibo to Estado Monagas, Venezuela; **F. J. D. Proper,** engineer, C. P. I. M., The Hague, Netherlands, to Curacao, N.W.I.

DEATHS

James Finley O'Bryan, 56, processing superintendent at the Tulsa refinery of Mid-Continent Petroleum Corp., died July 16 in a Tulsa hospital.

Seymour G. Lockwood, 84, retired oil operator, died in a Tulsa hospital July 15.

Paul H. Thompson, Sr., 55, chief electrician, Sinclair Refining Co., Tulsa, died July 17.

Allen L. Owens, 50, oil-field contractor, died July 12 in Olean, N. Y.

William Wirt King, Jr., 47, attorney for Sinclair Oil Co., died July 15 in Chicago. King was a cousin of Harry F. Sinclair, president of the company.

Robert H. Rowe, 36, chemist at the Sand Springs, Okla., refinery of Sinclair Refining Co., died in Tulsa July 17.

Norman P. Karns, 85, veteran drilling contractor, died July 14 in Oil City, Pa.

J. D. Patrick, 69, independent oil operator, Taft, Tex., died July 10. Patrick had his own drilling company and various producing properties.

Hervey A. Haltiwanger, 58, manager of the land and lease department, Derby Oil Co., died July 15 in a Wichita hospital. Haltiwanger was chairman of the nomenclature committee of the Mid-Continent Oil and Gas Association.

A. W. Hunter, for many years active in oil development in Alberta, was killed recently when a cable broke on casing being unloaded at the Maxmont well in the southern Alberta foothills.

Henry N. Greis, 67, president of Deep Rock Oil Co. and Burke-Greis Oil Corp., died at his Tulsa home July 16. In addition to the presidency of Burke-Greis and Deep Rock, Greis held directorships in the Mid-Continent Petroleum Corp., Oklahoma Natural Gas Co., and the First National Bank & Trust Co. at the time of his death. During his long and active career in the industry, Geis had been vice president of Central Torpedo Co.; president of Packard Oklahoma Motor Sales Co.; president of the Wyoming Torpedo Co.; a member of the firm of Wescott & Greis, equipment dealers; president of Lago Petroleum Corp. of Venezuela; and president of Atlantic Petroleum Co. He was a member of the 25-year club of the American Petroleum Institute and served as director of that organization.

Midyear Report STARTS NEXT PAGE

A Reappraisal of the VOLUMETRIC OUTLOOK for the Petroleum Industry for 1947

E. T. Knight

AVAILABLE data indicate that the 1947 demands for crude and petroleum products projected in the March 22, 1947, issue of The Oil and Gas Journal will be exceeded by nearly 3 per cent and will approximate 5,754,400 bbl. daily. Currently it appears that the 1947 domestic and export demands will be above those of 1946 by nearly 8.1 per cent or 430,000 bbl. daily. It had previously been projected that the domestic demands for petroleum and products would exceed the 1946 demands by 272,250 bbl. daily or 5.5 per cent. However, indicated domestic requirements during the first 6 months of 1947 reached a level nearly 11 per cent or 529,000 bbl. daily above the comparable demands for 1946.

On the basis of trends indicated during recent months, it is now considered that the domestic requirements during the last half of 1947 will average 5,317,000 bbl. daily, an amount 342,100 bbl. daily or 6.8 per cent greater than the domestic demands for the closing 6 months of 1946.

The domestic demands for kerosine and distillate fuels, as indicated for the first 6 months of 1947, have exceeded the expectations of many forecasters. During the most recent 6-month period the combined domestic demands for these products averaged 1,149,600 bbl. daily, an increase of 20.9 per cent or 198,550 bbl. daily over

*Petroleum economist, The Atlantic Refining Co.

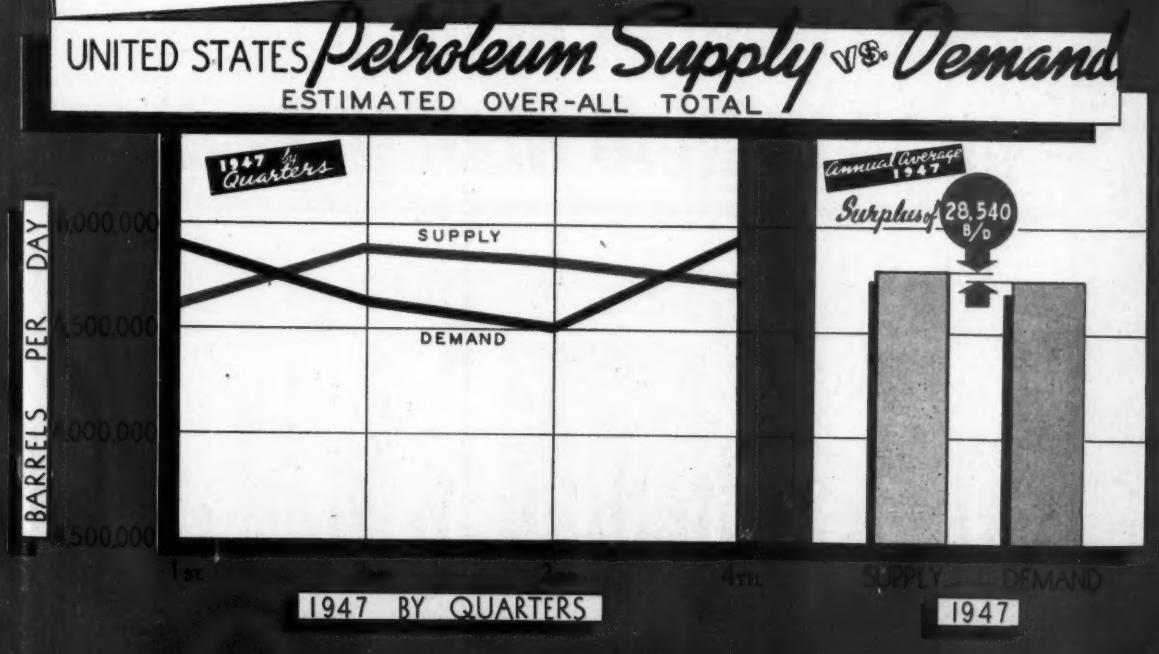
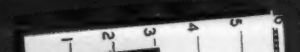


TABLE 1 Demands and Supply of Petroleum Products

(Barrels Daily)

	First quarter		Second quarter		Third quarter		Fourth quarter		Year 1947	
	Actual	% increase over 1946	Estimated	% increase over 1946	Forecasted	% increase over 1946	Forecasted	% increase over 1946	Forecasted	% increase over 1946
Motor fuel	2,006,810	*5.4	2,368,130	7.0	2,498,920	10.2	2,308,710	6.8	2,297,030	7.5
Domestic	1,864,220	7.6	2,253,130	6.8	2,373,920	10.3	2,183,710	6.3	2,170,190	7.8
Export	142,590	*17.1	115,000	11.0	125,000	8.1	125,000	16.8	126,840	2.0
Kerosine	393,390	17.2	249,780	10.2	206,520	8.5	347,680	8.8	298,960	11.7
Domestic	365,960	14.5	227,800	18.3	184,780	13.8	325,940	7.4	275,760	12.9
Export	27,430	78.5	21,980	*35.8	21,740	*22.0	21,740	33.5	23,200	*1.1
Distillate fuels	1,129,810	25.5	704,950	1.6	604,350	8.5	934,790	11.5	842,280	13.0
Domestic	1,069,550	29.0	639,010	13.5	539,130	14.0	869,570	8.7	778,110	17.0
Export	60,260	*13.6	65,940	*49.4	65,220	*23.2	65,220	77.0	64,170	*20.2
Residual fuels	1,557,230	8.6	1,418,680	9.0	1,293,480	7.4	1,494,570	7.2	1,440,420	8.0
Domestic	1,527,320	8.6	1,391,210	8.6	1,266,310	7.8	1,467,400	7.2	1,412,490	8.0
Export	29,910	6.8	27,470	28.0	27,170	*5.2	27,170	5.0	27,930	7.5
Lubricants	135,310	19.8	144,610	13.6	146,410	10.7	142,060	8.6	142,130	12.9
Domestic	95,110	13.7	106,150	11.8	108,370	6.3	104,020	2.5	103,450	8.2
Export	40,200	37.2	38,460	19.0	38,040	25.8	38,040	29.7	38,680	27.7
Other products (inc. refinery losses)	545,760	18.5	591,530	5.9	594,320	*6.8	550,930	*3.0	570,720	2.5
Domestic	521,950	17.7	568,780	6.0	576,990	*7.2	533,600	*3.0	550,440	2.2
Export	23,810	39.4	22,750	4.6	17,330	8.9	17,330	*2.0	20,280	12.0
Crude oil (as fuel, losses and export)	151,150	37.4	170,000	4.2	180,000	2.7	150,000	*9.5	162,820	5.9
Domestic	54,080	49.8	50,000	6.2	50,000	39.0	50,000	1.8	51,000	21.2
Export	97,070	31.4	120,000	3.5	130,000	*6.6	100,000	*14.3	111,820	0.2
Demand for all oils	5,919,460	12.6	5,647,680	6.9	5,524,000	7.0	5,928,740	6.3	5,754,360	8.1
Domestic	5,498,190	13.4	5,236,080	8.5	5,099,500	8.0	5,534,240	5.9	5,341,440	8.9
Export	421,270	3.9	411,600	*10.5	424,500	*4.1	394,500	12.8	412,920	*0.3
Stock change, all oils	—289,450	...	+269,000	...	+320,510	...	—190,200	...	+28,540	
Total new supply	5,630,010	7.0	5,916,680	3.0	5,844,510	5.3	5,738,540	4.6	5,782,900	6.3
Imports	482,440	34.5	473,080	30.0	466,750	20.8	456,630	23.1	469,680	26.9
Crude	283,000	24.1	300,000	24.9	300,000	21.1	280,000	23.2	290,770	23.3
Products	199,440	52.5	173,080	40.0	166,750	20.1	176,630	23.0	178,910	33.3
Domestic supply	5,147,570	5.0	5,443,600	6.5	5,377,760	4.1	5,281,910	3.3	5,313,220	4.8
Natural gasoline and benzol	351,430	9.3	368,000	18.5	368,000	16.9	353,000	4.5	360,120	12.1
Crude-oil production	4,796,140	4.7	5,075,600	6.1	5,009,760	3.3	4,928,910	3.2	4,953,100	4.3

*Decrease.



the indicated demands for the comparable period a year previous. It is expected that the combined demands for kerosine and distillate fuels for the coming 6 months will approximate 960,000 bbl. daily, more than 10 per cent greater than the demands for the last 6 months of 1946.

In the main, the domestic demands for other petroleum products have followed fairly closely the previously projected trends. Export demands for nearly all products, however, have been below those forecasted and, based upon the first 6 months' experience and a current forecast for the remainder of the year, will average 413,000 bbl. daily in 1947, an amount insignificantly below the 1946 average exports of crude oil and products.

Should the demands as projected for the last 6 months of 1947 be realized and the importation of crude and products follow the trends presented in Table 1, the oil industry will be required to produce 4,953,100 bbl. daily or 4.3 per cent more than the average production of 1946. The quarterly production of crude oil in the United States is summarized in Table 2.

TABLE 2—UNITED STATES PRODUCTION OF CRUDE OIL

	1947 (bbl. per day)	Per cent change from previous year	1946 (bbl. per day)
First quarter	4,796,140	+4.7	4,581,640
Second quarter	5,075,600	+6.1	4,784,830
Third quarter	5,009,760	+3.3	4,850,060
Fourth quarter	4,928,100	+3.2	4,776,840
Year average	4,953,100	+4.3	4,749,160

The crude-oil production as forecasted for the remaining months of this year considers that stocks of crude oil will decline 56,350 bbl. daily from current levels. The actual production during the opening 6 months of the year resulted in the accumulation of crude-oil stocks at the rate of 112,510 bbl. daily. Stocks of crude oil at the end of the year may be nearly 10,000,000 bbl. greater than the stocks on January 1, 1947. It is the opinion of some economists that current stocks could be increased during the last 6 months of this year at the rate of 60,000 bbl. daily in order that more efficient operations could be attained. However, such an increase was not considered here. In fact, a decline in stocks has been considered in determining the need for crude-oil production.

It will be noted that the projected domestic production was established after considering that the imports of crude and products during the coming 6 months will be somewhat below the rate recorded during the opening quarter of the year and 10,000 bbl. daily below an estimated second quarter rate of importation.

In establishing the probable rate of crude-oil production for the next 6 months, it was considered that stocks of products at the end of 1947 would be at approximately those levels recorded on January 1, 1947. The changes in stocks of crude and products employed for projecting the operations during the coming 6 months are presented in Table 3 along with indicated stock changes during the first half of the year.

TABLE 3

	Projected stock changes second 6 months, 1947 (bbl. per day)	First quarter actual second quarter estimated stock changes (bbl. per day)
Crude oil	—56,350	+112,510
Products	+121,500	—121,200
Total	+65,150	—8,690

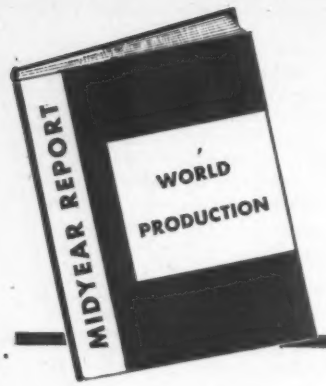
Provided the demands for the last half of 1947 as indicated in Table 1 materialize, refiners during the remainder of the year will be required to process on the average 5,072,000 bbl. daily of crude. That rate of processing would be 192,000 bbl. daily greater than the average for the first 6 months of 1947 but approximately 92,000 bbl. daily below the recorded processing of 5,164,000 bbl. daily established during the week of June 14, 1947.

The forecasted rate of crude runnings, although below the rated capacity of all United States refineries, will require the maximum of operation of refineries in specific areas. Indeed, it may be expected that some areas will experience difficulties in maintaining their relative positions in the refining economy.

There are rumors of impending shortages. It is the opinion of some that those rumors are detrimental to the industry's operations in that a certain amount of uneconomic holding of stocks of material prevents the normal flow of goods between districts and even between operators within districts.

Although some shortages may become apparent near the end of the year, they will occur in limited geographic areas and may possibly be averted if all available storage capacities are utilized. The consumers of products, particularly consumers of distillate fuels, can help the oil industry in its operations by preuse filling of home fuel tanks.

The oil industry is today engaging in practices that are uneconomic in order that the consumer may receive the maximum of his requirements. Cooperation of the consumer will help minimize the extent of these uneconomic practices and will decrease the severity of shortages which may develop.



Increase of 50 Per Cent Seen in Global Oil Output

. . . excluding United States

by Warren W. Burns

WITH foreign oil planning having been greatly accelerated during the first half of 1947, the significance of oil-producing activities outside of the United States becomes ever more apparent in the international pattern of supply of demand.

From a survey made this month among oil companies having foreign producing properties, The Oil and Gas Journal's latest estimate of 1947's probable world production, exclusive of the United States but including Russia, is 3,054,500 bbl. daily. This compares with the 1946 world output, exclusive of the United States, of 2,764,500 bbl. daily, or a probable increase this year of 290,000 bbl. daily.

And indicative of things to come is the fact that well-informed foreign oil sources estimate daily world production (exclusive of the United States but including Russia) in 1951 at 4,654,500 bbl., or a possible increase of 1,600,000 bbl. daily over the 1947 output.

Probably the most significant foreign oil production developments in the past 6 months were seen in Chile and in the completion of five wells at Canada's Leduc field, some 20 miles south of Edmonton. Whether this will become a "second Turner Valley" awaits the drilling of several additional wells. But oil men close to the situation are confident enough to predict that Canada's daily crude-oil production will be at least 40,000 bbl. by 1951, or double the probable daily average this year.

Chilean Well Expects Good Show

In Chile, the Corporacion de Fomento de la Produccion completed its sixth test well early in June with all indications that the well will have a good show of oil. The seventh and eighth wells are to be spudded in the immediate future. By 1951 Fomento probably will have a 10,000-bbl. daily refinery within Chilean borders and there is every indication that there will be enough indigenous crude for this operation. So far Fomento's oil wells have been capped due to lack of transportation facilities.

Possibly the greatest general interest in any single foreign oil development still centers about conjecture as to when the expanded partnership deal will be consummated between Arabian American Oil Co., on the one hand, and Standard Oil Co. (N.J.) and Socony-Vacuum Oil Co., Inc., on the other. However, for all practical purposes, the partnership is well under way, for in March Jersey Standard and Socony-Vacuum announced a financial arrangement whereby Aramco was advanced $227,000,000. At that time it was explained that plans were being made to increase Saudi Arabia's daily crude-oil output to between 500,000 and 600,000 bbl. by the end of 1949. Whether this increased production actually moves to the Mediterranean in 1949

WORLD OIL PRODUCTION OUTSIDE THE UNITED STATES

(Thousands of barrels daily)

		Forecast	
North America:	**1946**	**1947**	**1951**
Canada	21	20	40
Mexico	145	145	160
Total North America excl. United States	166	165	200
South America:			
Venezuela	1,065	1,200	1,350
Colombia	61	66	52
Argentina	57	55	46
Trinidad	55	53	46
Peru	35	34	32
Chile	....	....	10
All other	7	4	8
Total South America	1,436	1,555	1,674
Total Western Hemisphere excl. U. S.	1,602	1,720	1,874
Europe:			
Austria	15	12	15
Germany, excl. Soviet zone	13	12	13
Romania	86	80	75
France	1	1	1
Great Britain	1	1	1
Poland	2	2	1
Yugoslavia	1	1	1
Total Europe excl. Russia	119	109	107
Middle East:			
Egypt	25	22	20
Iraq	97	97	275
Iran	395	400	*650
Saudi Arabia	164	242	†680
Bahrein	22	23	21
Kuwait	19	65	200
Qatar	....	....	20
Total Middle East	722	849	1,866
Far East:			
China	2	4	5
India	7	8	10
Burma	1	2	10
Japan	4	4	4
British Borneo	10	10	20
Dutch East Indies	6	15	200
Total Far East	30	41	249
Total Eastern Hemisphere	871	999	2,222
Russia (unofficial estimates)	457	500	780
Total world (outside U.S.)	2,930	3,219	4,876

*Assuming completion of Iran-Kuwait-Mediterranean pipe line. †Assuming completion of Trans-Arabian pipe line.

depends upon whether the trans-Arabian pipe line is completed. Currently, Saudi Arabia has 50 producing wells with 7 rigs drilling.

Approximately 250,000 tons of line pipe and casing are now being shipped to the Middle East from Los Angeles for the trans-Arabian 30-31-in. line.

Plans for another Middle East big inch line were divulged in March on the arrival in this country of Sir William Fraser, board chairman of Anglo-Iranian Oil Co., Ltd. Anglo-Iranian, holding a 50 per cent interest, will join hands with Jersey Standard, with a 40 per cent interest, and Socony-Vacuum, with a 10 per cent interest, in constructing a line (which may be 34-36-in. dimensions) from Iran and Kuwait to the Mediterranean. That sufficient crude oil will be available for this line—which probably won't be completed until 1952 at the earliest—is seen in plans of Kuwait Oil Co., Ltd., jointly owned by Anglo-Iranian and Gulf Oil Corp., to up production to 100,000 bbl. daily by the end of this year and to 160,000 bbl. daily by the end of 1948. The 200,000-bbl. daily estimate in an accompanying table is probably a low figure for 1951.

Ten Wells Planned for Qatar

Another Persian Gulf sheikdom which undoubtedly will be enjoying social and economic benefits from oil production by 1950 or 1951 is Qatar.. Within the next 2 to 3 years at least 10 wells are planned to be drilled in Qatar's Dukhan field which was shown to have production early in the war. However, the wells were plugged when it was feared Nazis might invade that region.

Whether the Persian Gulf has an excess of crude production before fields in the Netherlands East Indies are reconditioned depends largely upon the political situation in the N.E.I. But the possibilities of shipping Persian Gulf crude to N.E.I. refineries is not remote.

That the Middle East is an even greater reservoir of world oil was indicated last month when E. DeGolyer, internationally known geologist, revised his 1944 reserve estimates. Thus, the Middle East reserve picture looks about like this:

Iraq—5 billion barrels, up 1 billion.

Iran—6 to 8 billion barrels, up from 5 to 6 billion.

Saudi Arabia—5 to 7 billion barrels, up from 4 to 5 billion.

Kuwait—9 billion barrels, up from 4 billion.

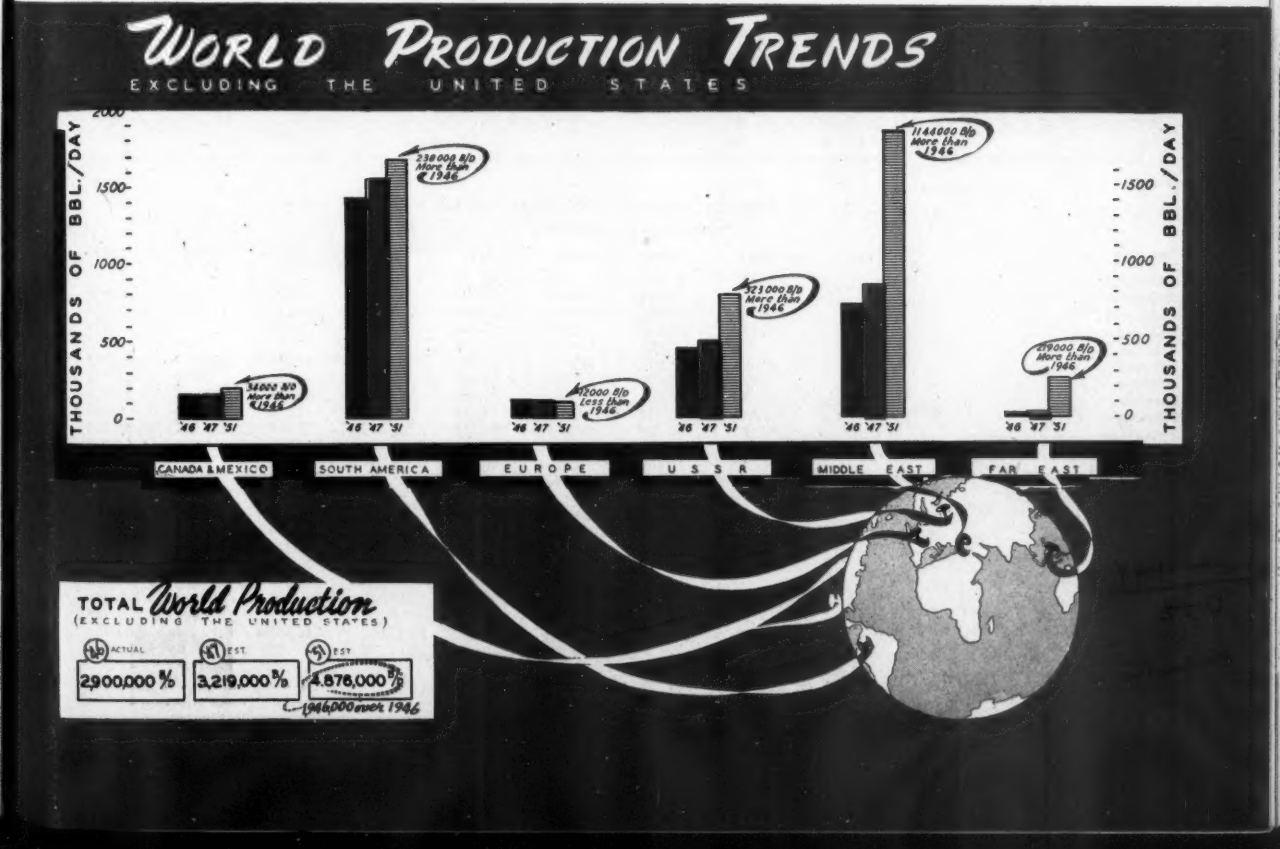
Qatar—1 billion barrels, up from 500,000,000.

Middle East Again in News

Last month Middle East oil again figured prominently in the news when the United Nation's Economic and Social Council received a proposal from the International Cooperative Alliance to create a United States Oil Authority to administer the world's oil resources—with emphasis on Persian Gulf output. Every indication points to this situation being a "tempest in a teapot," but its significance possibly lies in the fact that the co-ops have a voice, though no vote, on the United Nations Economic and Social Council. This entire situation was first discussed by The Oil and Gas Journal earlier this year (January 11, page 47).

The first half of this year also saw construction on Iraq Petroleum Co., Ltd.'s Kirkuk-Haifa 16-in. pipe line progressing to the point where more than 160 miles had been laid and approximately 200 miles of ditching had been completed. January 1949 is the tentative date for completion of the Kirkuk-Haifa line and January 1950 for completion of the Kirkuk-Tripoli line. When both lines are completed, the daily crude-oil capacity will approximate 275,000 bbl. from Kirkuk to the Mediterranean. Construction of another Kirkuk-Mediterranean line now appears more of a certainty that it did a few months ago. If and when completed this big inch line probably would hike Iraq's daily crude-oil deliveries to the Mediterranean to between 500,000 and 600,000 bbl. That the line probably will be built is seen from the fact that Cie.

(Continued on page 183)



United States Production Now Exceeding That of War Peak

CRUDE production in the first half of 1947 exceeded the wartime peak of the first half of 1945 by about 3 per cent; increased over the same period of 1946 by a little over 5 per cent. On net balance the average production of 1947 and 1946 first half is just a shade over the 1945 wartime output. That means that for 3 years in a row the industry has been straining to the limit of its facilities to meet the demand.

This is entirely contrary to anticipations following V-J Day. Then the industry looked forward with welcome relief to a probable decrease of 10 per cent in production requirements, followed by a gradual buildup back to the wartime peak somewhere between 1948 and 1950. This was to be the period during which the industry would overhaul and reequip its productive facilities in a gradual and orderly manner. And, of course, this reequipping was to take place in at least a semibuyer's market for steel and the new equipment.

Instead of that postwar picture of busy but ordered activity without strain, there has been something entirely different. Despite constant shortages of steel, the industry has had to drill and drill and drill wells, absorbing new equipment for these new wells, instead of overhauling the existing wells. The new equipment for the older wells is coming in, but much more gradually than anticipated; and frequently lack of balance in equipment available has prevented planned substantial overhauling of some major producing facilities. There is substantial progress being made, but not as quickly as desirable,

1947 PRODUCTION (FIRST HALF)—PRINCIPAL INCREASES
(Thousands of barrels)

	1947 first half	1946 first half	Increase
Texas	389,477	371,596	17,881
California	170,790	156,733	14,057
Mississippi	16,048	10,461	5,587
Louisiana	73,081	68,870	4,211
Kansas	50,294	46,444	3,850
Oklahoma	68,709	67,748	961
All others	126,327	126,664	*337
Total United States	894,726	848,516	46,210

*Decrease.

1947—LOCAL SUPPLY IN EAST PART OF DISTRICT 2
(Thousands of barrels)

	Change 1947 vs. 1940	1947 first half	1946 first half	1940 first half
Illinois	—45,311	33,434	37,684	78,745
Indiana	+ 1,508	3,240	3,475	1,732
Kentucky	+ 2,137	4,687	5,303	2,550
Michigan	— 3,384	7,673	8,326	11,057
Ohio	+ 24	1,525	1,412	1,501
Total	—45,026	50,559	56,200	95,585

1947—ROCKY MOUNTAIN PRODUCTION RECORD
(Thousands of barrels)

Wyoming	20,963	19,175	+1,788
Colorado	6,770	4,548	+2,222
Montana	4,196	4,506	— 310
Total region	31,929	28,229	+3,700

UNITED STATES PRODUCTION—FIRST HALF YEAR
(Thousands of barrels)

	1947	1946	1945	1944	1943	1942	1941	1940
Alabama	171	191	79	8	.....	.....	.....	.....
Arkansas	14,462	14,042	14,493	14,579	13,314	13,233	12,846	12,664
California	170,790	156,733	165,801	151,049	139,839	114,511	111,849	111,221
Colorado	6,770	4,548	1,832	1,354	1,085	1,057	781	636
Florida	73	27	11	8	.....	.....	.....	.....
Illinois	33,434	37,684	37,492	39,095	41,919	57,871	60,954	78,745
Indiana	3,240	3,475	2,365	2,559	2,694	3,557	3,376	1,732
Kansas	50,294	46,444	48,480	49,553	54,712	45,100	37,612	31,323
Kentucky	4,687	5,303	4,959	4,232	3,467	2,114	2,420	2,550
Louisiana	73,081	68,870	64,248	64,285	59,897	57,860	55,325	52,093
Michigan	7,673	8,326	8,710	9,445	10,566	10,357	6,964	11,057
Mississippi	16,048	10,461	9,154	7,667	9,940	15,862	4,240	1,341
Montana	4,196	4,506	4,214	4,337	3,737	3,980	3,575	3,348
Nebraska	115	147	159	208	378	701	642	.....
New Mexico	18,952	17,451	18,847	20,284	18,036	15,228	19,127	20,121
New York	2,359	2,425	2,263	2,363	2,555	2,692	2,499	2,611
Ohio	1,525	1,412	1,391	1,500	1,626	1,771	1,616	1,501
Oklahoma	68,709	67,748	67,501	60,703	61,812	71,615	75,875	78,800
Pennsylvania	6,270	6,480	6,279	7,296	8,089	9,015	8,117	9,059
Texas	389,477	371,596	391,750	355,771	257,977	236,694	243,220	255,357
West Virginia	1,346	1,448	1,450	1,570	1,707	1,787	1,681	1,707
Wyoming	20,963	19,175	18,299	15,667	15,965	15,499	14,588	11,984
Miscellaneous	91	24	27	24	27	32	31	51
Total United States	894,726	848,516	869,802	813,557	709,342	680,536	667,338	687,901

and not nearly as easily accomplished as visualized right after V-J Day.

There has been no change in the rank of the first six producing states, Texas, California, Louisiana, Oklahoma, Kansas, and Illinois still holding those positions. Illinois, however, dropped off over 4 million barrels from the first half of 1946, while the other five states all showed increases, although Oklahoma's was small, a little under 1 million barrels.

Only four other states produced 10 million barrels or more during the first half. Wyoming and New Mexico retained seventh and eighth places, but Mississippi increased its production about 5½ million barrels to take ninth place away from Arkansas, which dropped into tenth position. Mississippi is now crowding on the heels of New Mexico, and while hardly likely to displace that state in 1947, it may be a different story next year.

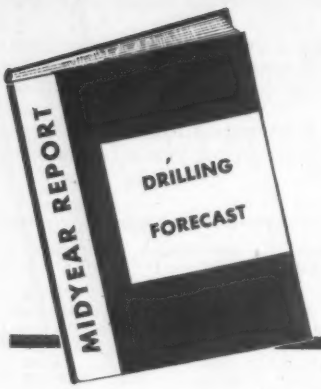
There has been much talk about the probable shortage of oil in the Middle West, i.e., in parts of old PAW District 2. The accompanying tabulation, "Local Supply in East Part of District 2," is included to give the prewar and postwar local production picture as an explanation of the situation. The comparison is made on the basis of 1940 vs. 1947, because in the first half of 1940 the national-defense program had not yet distorted peacetime markets, whereas by 1941 this was beginning to be an element.

This tabulation shows 45 million barrels less local crude available during the first half of 1947 (the first fully normal postwar half year), than there was during the first half of 1940 (the last fully normal prewar half year). Meantime in the 7-year interval the refining capacity has increased substantially, and so has the market demand for products. The 45-million-barrel shortage is equal to 90 to 100 million barrels annually, which must be brought in by some means of transportation from other oil-producing areas.

The prospects for total United States production in the last half of 1947 are that a new all-time-high record will be achieved.

UNITED STATES PRODUCTION—DAILY AVERAGE PER WELL

	1947 (thou. bbl.)	Prod. wells 7-1-47	Daily avg. bbl. per well	Cumulative prod., thou. bbl.
Alabama	171	29	32.6	775
Arkansas	14,462	3,344	23.9	687,840
California	170,790	23,635	39.9	7,457,099
Colorado	6,770	475	78.7	73,254
Florida	73	4	100.8	192
Illinois	33,434	29,390	6.3	1,282,070
Indiana	3,240	2,760	6.5	170,499
Kansas	50,294	27,550	10.1	1,723,905
Kentucky	4,687	14,679	1.8	219,551
Louisiana	73,081	8,454	47.8	1,891,431
Michigan	7,673	3,553	11.9	264,483
Mississippi	16,048	1,361	65.1	142,850
Montana	4,196	2,485	9.3	137,029
Nebraska	115	55	11.6	5,150
New Mexico	18,952	4,793	21.8	517,416
New York	2,359	17,600	0.7	161,419
Ohio	1,525	22,370	0.4	608,950
Oklahoma	68,709	53,080	7.2	5,716,880
Pennsylvania	6,270	56,017	0.6	1,082,843
Texas	389,477	105,672	20.4	10,816,456
West Virginia	1,348	16,446	0.5	431,350
Wyoming	20,963	4,158	27.9	724,935
Miscellaneous	91	123	4.1	1,533
Total U. S.	894,776	398,033	12.4	34,117,910



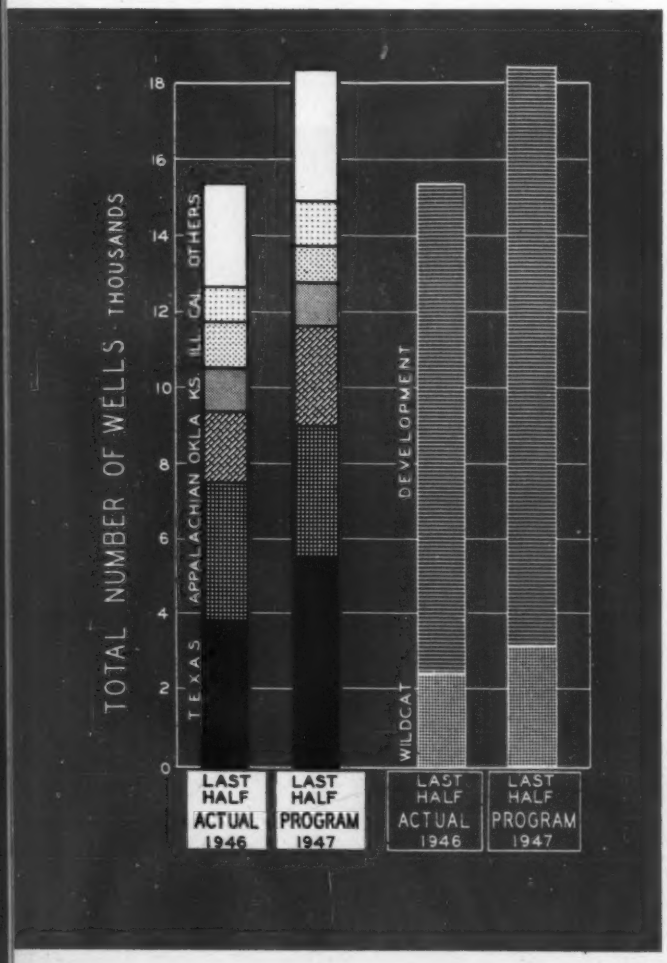
18,000 Wells, 68 Million Feet Seen for Last Half of Year

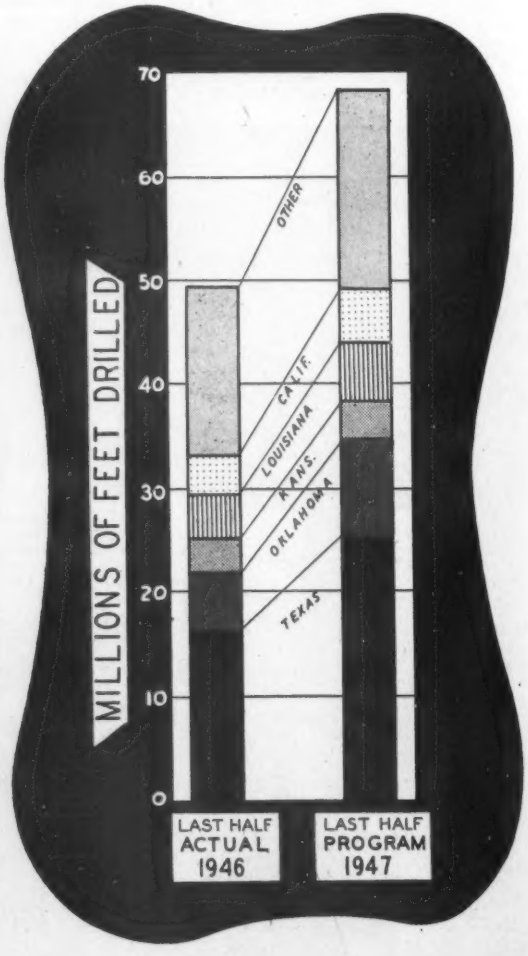
by Charles J. Deegan

THERE will be no shortage of crude this fall, if the producing branch of the industry can get the pipe and drilling rigs to drill all the wells they have scheduled for completion during the last half of 1947—and if transportation is available. Replies to The Oil and Gas Journal's questionnaires indicate that the greatest drilling campaign in the history of the industry is slated for the last half of this year.

The program for the last half of the year calls for over 18,000 wells and over 68 million feet to be drilled. Over 3,000 of the wells are scheduled to be wildcat tests, bringing the total for the year up to nearly 5,500 exploration wells, the greatest number ever drilled in the history of the industry in a single year.

In the tabulations accompanying this article, the details of the program are outlined by areas, so that a comparison can be had from three different angles. The program for the last half of 1947 is compared to the last half of 1946; it is also compared with the first half of 1947; and finally the first half actual 1947 results plus the last-half program is compared with the original schedules established by the operators in December 1946 as their probable 1947 program. This last comparison shows that the unexpectedly large demand for crude has caused operators to hike their development-well program by





12.5 per cent over original intentions, and to increase their wildcat program by 8.4 per cent over their December 1946 plans.

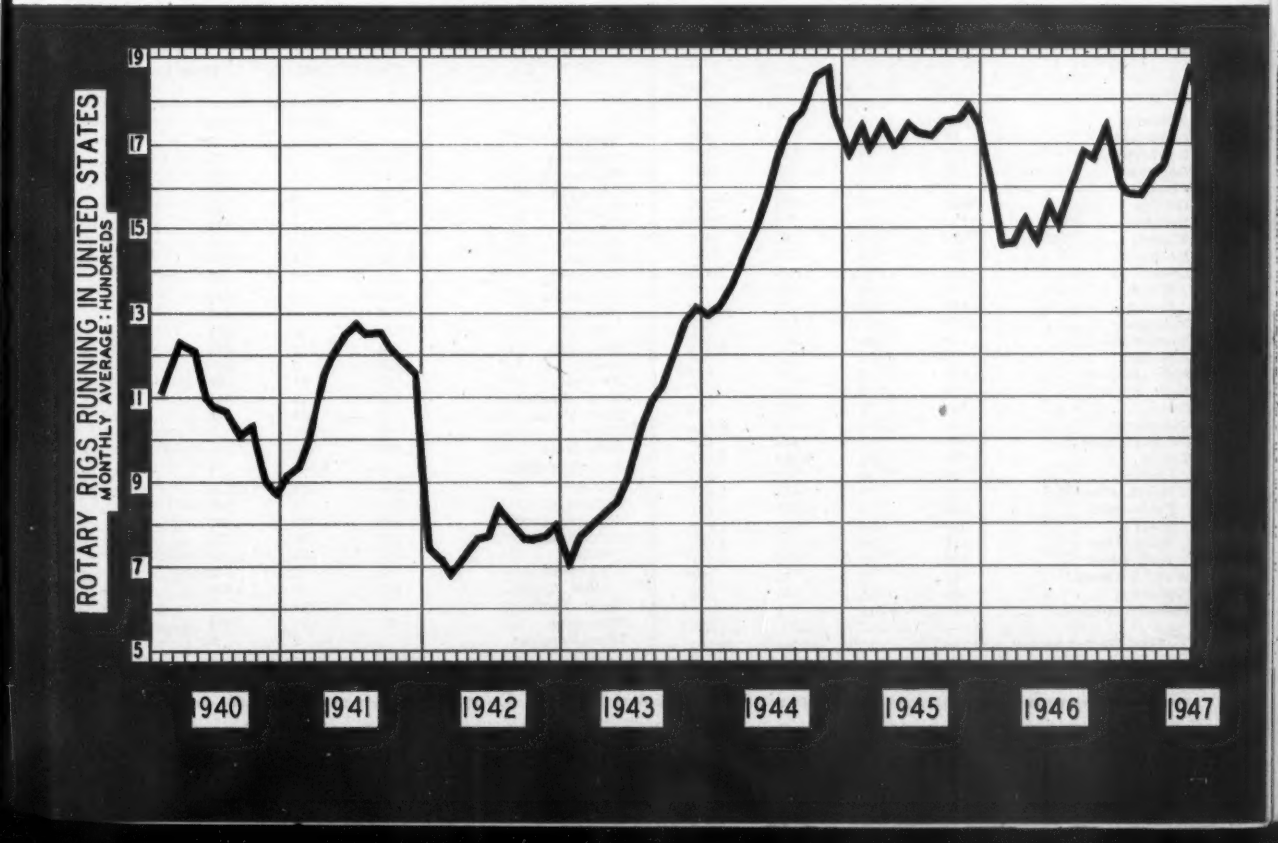
With some allowance for unforeseen developments, the major drilling program for the last half of 1947 in some districts can be forecast reasonably well as to hot spots. The pools or areas in which the greatest activity will be concentrated are likely to be as given in the list below:

Texas Gulf Coast.—The same fields which led in the first half will probably continue, namely, Tom O'Connor, Sugar Valley, Lolita, Saratoga, and Refugio-Heard. The new Bloomington field in Victoria County seems to be setting a fast development pace, and will probably be among the leaders in the last half.

Southwest Texas.—Continued drilling in the trend from the south end of Agua Dulce-Stratton to La

DRILLING FORECAST—LAST HALF 1947 VS. ACTUAL LAST HALF 1946

	Last half 1947 programed				Last half 1946 actual			
	Total wells	Wildcat wells	Development wells	Thousand feet	Total wells	Wildcat wells	Development wells	Thousand feet
Alabama	8	6	2	33	9	6	3	41
Arkansas	152	36	116	686	93	30	63	380
California	1,184	162	1,022	5,200	887	139	748	3,753
Colorado	175	33	142	1,048	103	10	93	642
Florida	12	9	3	100	13	12	1	76
Illinois	991	307	684	2,600	1,279	380	899	3,302
Indiana	288	53	235	530	316	76	240	593
Kansas	1,154	182	972	3,660	1,080	170	910	3,441
Kentucky	265	17	248	428	362	59	303	602
Louisiana	875	180	695	5,530	735	134	601	4,204
North	444	80	364	1,660	447	62	385	1,512
South	431	100	331	3,870	288	72	216	2,592
Michigan	597	131	466	1,256	422	119	303	869
Mississippi	303	75	228	2,445	136	41	95	1,046
Montana	147	20	127	300	172	22	150	362
New Mexico	387	30	357	1,670	228	21	207	928
New York	845	0	845	1,195	740	0	740	1,054
Ohio	646	24	622	1,850	694	32	662	1,861
Oklahoma	2,651	519	2,132	8,900	1,810	366	1,444	5,459
Pennsylvania	1,484	47	1,437	2,500	1,840	0	1,840	2,939
Texas	5,559	1,153	4,406	26,010	3,859	815	3,044	16,623
Eastern	347	96	251	1,967	320	58	262	1,282
North Central	1,774	310	1,464	5,330	1,295	319	976	3,433
Panhandle	362	8	354	1,348	137	0	137	416
West	1,261	155	1,106	6,515	957	115	842	4,800
Southwest	742	278	464	3,880	314	140	174	1,046
Gulf Coast	1,073	306	767	6,970	836	183	653	5,646
West Virginia	452	20	432	1,253	406	0	406	1,065
Wyoming	212	53	159	1,009	86	20	66	368
Miscellaneous	8	4	4	38	19	17	2	40
Total United States	18,395	3,061	15,334	68,241	15,289	2,469	12,820	49,648



Gloria is definitely in sight. This will include wells in Stratton, Seeligson, Tijerina-Canales, and La Gloria, with probably slow development of the intervening Monte Negra and Borregas links on the King Ranch. In addition, development will probably continue at a good pace in Charlotte and Kelsey Deep pools.

West Texas.—Large extensions during the first half indicate that Keystone, Fullerton, and TXL fields will be among the leaders in the last half year. Levelland and Sharon Ridge will also maintain a position among the most active fields.

Southern Louisiana.—Egan, Charenton, Port Barre, Tepetate and West Tepetate are likely to lead ac-

DRILLING FORECAST—LAST HALF 1947 VS. 1947 FIRST HALF

	47 programed—Last half 19				Increase over 1947 first half			
	All wells	Wildcat wells	Development wells	Thousand feet	All wells	Wildcat wells	Development wells	Thousand feet
Alabama	8	6	2	33	1	1	0	10
Arkansas	152	36	116	686	16	12	4	74
California	1,184	162	1,022	5,200	173	*27	200	761
Colorado	175	33	142	1,048	87	13	74	571
Florida	12	9	3	100	*3	*5	2	10
Illinois	991	307	684	2,600	96	92	4	277
Indiana	288	53	235	530	*12	*1	*11	*13
Kansas	1,154	182	972	3,660	*21	9	*30	*128
Kentucky	265	17	248	428	*26	*10	*16	*94
Louisiana	875	180	695	5,530	261	56	205	1,829
North	444	80	364	1,660	126	31	95	618
South	431	100	331	3,870	135	25	110	1,211
Michigan	597	131	466	1,256	230	10	220	480
Mississippi	303	75	228	2,445	77	33	44	550
Montana	147	20	127	300	38	6	32	79
New Mexico	387	30	357	1,670	119	5	114	429
New York	845	0	845	1,195	42	0	42	65
Ohio	646	24	622	1,850	45	*3	48	90
Oklahoma	2,651	519	2,132	8,900	653	120	533	2,712
Pennsylvania	1,484	47	1,437	2,500	31	38	*7	218
Texas	5,559	1,153	4,406	26,010	1,231	288	943	6,353
Eastern	347	96	251	1,967	104	37	67	647
North Central	1,774	310	1,464	5,330	404	43	361	1,174
Panhandle	362	8	354	1,348	152	4	148	671
West	1,261	155	1,106	6,515	222	62	160	1,509
Southwest	742	278	464	3,880	7	44	*37	146
Gulf Coast	1,073	306	767	6,970	342	98	244	2,206
West Virginia	452	20	432	1,253	57	2	55	148
Wyoming	212	53	159	1,009	110	26	84	514
Miscellaneous	8	4	4	38	2	*2	4	21
Total United States	18,395	3,061	15,334	68,241	3,207	663	2,544	14,956

*Decrease.

DRILLING FORECAST—LAST HALF 1947
Increases Over Last Half 1946 Actual

	Total wells	Wildcat wells	Development wells	Footage thous. ft.
Alabama	*1	0	*1	*8
Arkansas	59	6	53	306
California	297	23	274	1,447
Colorado	72	23	49	406
Florida	*1	*3	2	24
Illinois	*288	*73	*215	*702
Indiana	*28	*23	*5	*63
Kansas	74	12	62	219
Kentucky	*97	*42	*55	*174
Louisiana	140	46	94	1,326
North	*3	18	*21	48
South	143	28	115	1,278
Michigan	175	12	163	387
Mississippi	167	34	133	1,399
Montana	*25	*2	*23	*62
New Mexico	159	9	150	742
New York	105	0	105	141
Ohio	*48	*8	*40	*11
Oklahoma	841	153	688	3,441
Pennsylvania	*356	47	*403	*439
Texas	1,700	338	1,362	9,387
Eastern	27	38	*11	685
North Central	479	*9	488	1,897
Panhandle	225	8	217	932
West	304	40	264	1,715
Southwest	428	138	290	2,834
Gulf Coast	237	123	114	1,324
West Virginia	46	20	26	188
Wyoming	126	33	93	641
Miscellaneous	*11	*13	2	*2
Total United States	3,106	592	2,514	18,593

*Decrease.

1947 DRILLING PROGRAM BY DRILLING METHODS

	First half actual		Last half programed	
	Rotary comp.	Cable tool comp.	Rotary comp.	Cable tool comp.
Alabama	7	0	8	0
Arkansas	136	0	152	0
California	1,011	0	1,184	0
Colorado	73	15	175	0
Florida	15	0	12	0
Illinois	821	74	920	71
Indiana	101	199	175	113
Kansas	1,099	76	1,086	68
Kentucky	211	80	172	93
Louisiana	614	0	873	2
North	318	0	442	2
South	296	0	431	0
Michigan	248	119	398	199
Mississippi	226	0	303	0
Montana	68	41	92	55
New Mexico	249	19	350	37
New York	0	803	0	845
Ohio	2	599	2	644
Oklahoma	1,798	200	2,350	301
Pennsylvania	0	1,453	0	1,484
Texas	3,954	374	5,110	449
Eastern	243	0	347	0
North Central	1,182	188	1,498	276
Panhandle	180	30	316	46
West	883	156	1,134	127
Southwest	735	0	742	0
Gulf Coast	731	0	1,073	0
West Virginia	1	394	0	452
Wyoming	81	21	176	36
Miscellaneous	3	3	6	2
Total United States	10,718	4,470	13,544	4,851

tivity in the last half of 1947 as they did in the first half. The new Holmwood field in Calcasieu Parish may develop greater activity.

Oklahoma.—Development will fall into three general groups: (1) Continued exploration and development of semiproven and proven areas in the Garvin-McClain county district; (2) shallow drilling in Cotton County; and (3) reworking old areas, particularly Carter and Stephens in southern Oklahoma and the greater Seminole area of Pottawatomie, Seminole, and Hughes counties.

Kansas.—Continued development of Hugoton; extensions of semiproven areas and possible new discoveries in Rush, Stafford, and Rooks counties; reworking such older areas as Barton, Butler, Ellsworth, and Rice counties.

Illinois.—In southeastern portion of Clay County, from Sailor Springs area south to Clay City Consolidated pool; in Richland-Edwards counties around the Parkersburg area; in Jasper County in the Willow Hill area; and in southern White County in the Herald area.

Western Kentucky.—Cane Run pool in Daviess County; an area including Poole, Tunnell Hill, and New Cairo pools in Henderson-Webster counties; and the Guffie pool area in McLean County.

Indiana.—In Gibson County, on a southeast-northeast trend through the East Patoka pool, Princeton area, Owensville area, and Fleener pool. In Knox County, along the east side of the river, through Mt. Carmel. In Posey County, including Springfield area, New Harmony, Farmersville, and the new Solitude pool.

Michigan.—A drilling boom for the last half year, limited probably by supplies of pipe and possibly drilling rigs is indicated. Kimball Lake, West Monterey, Coldwater, Rockford, and Stony Lake will again likely be the most active oil areas.

Ohio.—Sandyville-Canton, Brush Creek - Zanesville, Cambridge, Ashland-Lorain, and Stewart should again be the leading fields in development during the last half, as there are enough proven locations to sustain a good pace. The townlot excitement at Sandyville-Canton has apparently passed its peak, and drilling is expected to spread back again into the rest of the field.

Colorado.—There is nothing in sight at this time to outrank the continued development of the remaining proven locations in Rangely.

Wyoming.—A major drilling boom for this state is definitely in sight for the last half of 1947. Structures in and around the Big Horn basin are expected to attract most activity. These will include some structures due for their first test; and others in which black oil was discovered at a time when there was a poor market and no pipe-line facilities. In the Wind River basin, Big Sand Draw, Crooks Gap, Beaver Creek, Steamboat Butte, Sheldon, and Pilot Butte will undergo continuous development. A substantial number of wildcats will be drilled all over the state, including several inner-basin tests as distinguished from tests of rim structures around the edges of basins.

Montana.—Kevin-Sunburst and Cut Bank will probably lead development work in the last half, particularly Madison lime drilling at Cut Bank. A substantial number of shallow gas wells will be drilled in Bowdoin and Cedar Creek fields.

California.—Wilmington, Cymric, Lost Hills, Ventura Avenue, and West Newport should lead drilling activity in the last half as they did in the first. However, adverse conditions resulting from the Supreme Court decision on the Tidelands case might bring a slump in Wilmington. If so, Lompoc, Kern River, Midway-Sunset, and Cat Canyon activity may be stepped up.

REVISED 1947 DRILLING PROGRAM VS. ORIGINAL

First Half Actual Plus Second Half Program Vs. Original December 1, 1946, Program

	Total wells		Wildcat wells		Development wells		Footage to be drilled	
	Revised	Original	Revised	Original	Revised	Original	Revised	Original
Alabama	15	24	11	17	4	7	56	156
Arkansas	288	202	60	77	228	125	1,298	810
California	2,195	1,994	351	214	1,844	1,780	9,639	8,250
Colorado	263	164	53	30	210	134	1,525	1,065
Florida	27	24	23	21	4	3	190	182
Illinois	1,886	1,910	522	520	1,364	1,390	4,923	4,830
Indiana	588	679	107	49	481	630	1,073	1,225
Kansas	2,329	2,142	355	232	1,974	1,910	7,448	6,920
Kentucky	556	620	44	92	512	528	950	1,035
Louisiana	1,489	1,371	304	383	1,185	1,008	9,231	9,330
North	762	703	129	170	633	533	2,702	3,150
South	727	668	175	193	552	475	6,529	6,180
Michigan	964	673	252	175	712	498	2,032	1,495
Mississippi	529	490	117	142	412	348	4,340	3,990
Montana	256	327	34	61	222	266	521	710
New Mexico	655	587	55	83	600	514	2,911	2,550
New York	1,648	1,235	0	0	1,648	1,235	2,325	1,770
Ohio	1,247	1,395	51	20	1,196	1,375	3,610	3,570
Oklahoma	4,649	3,395	918	813	3,731	2,582	15,088	11,200
Pennsylvania	2,937	2,700	56	0	2,881	2,700	4,782	4,340
Texas	9,887	8,643	2,018	2,008	7,869	6,635	45,667	39,008
Eastern	590	727	155	225	435	502	3,287	4,000
North Central	3,144	2,825	577	605	2,567	2,220	9,486	7,750
Panhandle	572	491	12	13	560	478	2,025	1,558
West	2,300	2,110	248	280	2,052	1,830	11,521	11,050
Southwest	1,477	649	512	229	965	420	7,614	2,338
Gulf Coast	1,804	1,841	514	656	1,290	1,185	11,734	12,312
West Virginia	847	1,145	38	0	809	1,145	2,358	3,120
Wyoming	314	263	80	81	234	182	1,504	1,200
Miscellaneous	14	48	10	37	4	11	55	135
Total United States	33,583	30,041	5,459	5,035	28,124	25,006	121,526	106,891
Increase	11.8%		8.4%		12.5%		13.7%	

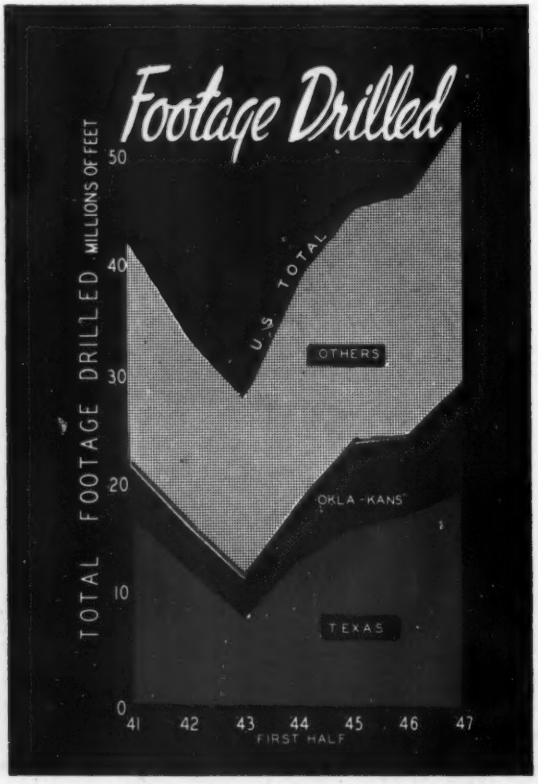
Only Steel Shortage Prevented Record-Breaking Year of Drilling

RESPONDING to an unprecedented peacetime demand for crude oil, the industry completed a near all-time record-breaking 15,189 wells in first half of 1947. This was an increase of 8.9 per cent over high rate of the same period last year. Reflecting the trend toward greater average depth of wells, total footage drilled increased 11.4 per cent over first half of 1946. Average depth of all wells was 3,510 ft., an increase over 3,358-ft. average of last year, but still shy of 3,538-ft. average depth in 1945, the last war year.

The record would have been higher, had it not been for the steel shortage which plagued operators during the entire first half. It slowed drilling in two ways. First, actual shortage of pipe for wells; second, shortage of line pipe left some areas, particularly West Texas, with insufficient pipe-line outlets for available production. Under such circumstances, many wells in these areas were postponed that would have been drilled had there been pipe-line outlets for the production which would have been obtained.

The steady increase in efficiency of drilling operations that has been noted since the war, continued during the first half of 1947. There were only 5.2 per cent more rotary rigs drilling this year than last, but all wells drilled totaled 11.4 per cent more footage. The comparison with the first half of 1945, during the worst pinch of the war, is even more marked. With 5.1 per cent fewer rotary rigs drilling in 1947 than in 1945, the total footage increased 17.5 per cent. These figures are based on allowing 1 month's time lag between number of rigs in operation, i.e., taking the December through May number of rigs in operation against the January through June well completions and footage. Not all the wells drilled, nor all the footage, were rotary, but rotary rigs account for the bulk of the drilling. It is believed that as a rough yardstick of increased efficiency the data are reasonably good.

Texas, as usual, led in both completions and total footage drilled. Considered as a total, the Appalachian area of Pennsylvania, New York, Ohio, and West Virginia accounted for 3,252 wells compared to 4,328 for Texas and 1,998 for Oklahoma. As an individual state, Oklahoma was second. The



respective footage figures were: Texas 19,657,000 ft., Appalachian area 6,278,000 ft., and Oklahoma 6,188,000 ft. The average depth of wells in these three were: Texas 4,542 ft., Appalachian 1,931 ft., and Oklahoma 3,098 ft. Thus with less than two-thirds as many wells, Oklahoma accounted for almost as much footage as the entire Applachian area.

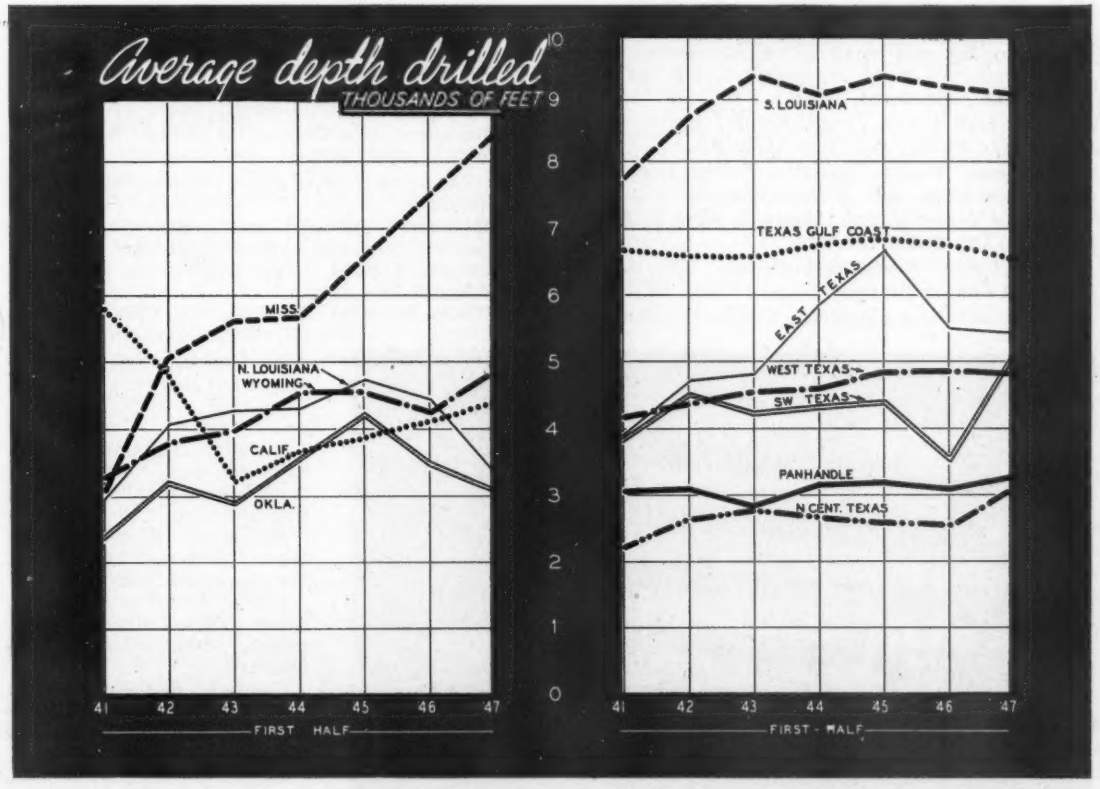
The reason that the Appalachian area ranks so high in drilling activity as compared to its production is the high price for oil and gas that prevails, plus the great amount of drilling involved in secondary-recovery water flooding in Bradford and Allegany fields.

The increase in completion activity was widespread, but Kentucky, Illinois, North Louisiana, and Montana showed drops. In Louisiana the drop was in the northern part, due to slackening of the development in the Delhi-Big Creek area; the southern part of the state was exactly the same as last year.

Wildcatting was up almost 20 per cent over the same period last year. The increase in total wildcat completions was 393. Oklahoma had an increase of 122, Texas 89, Cali-

SUMMARY OF COMPLETED WELLS, FIRST 6 MONTHS, 1947

	Total comp.	Oil	Gas	Dry	Service	Ave. footage	Total Jan.-June 1946
New York	803	407	0	0	396	1,408	721
Pennsylvania	1,453	747	118	33	555	1,570	1,711
West Virginia	395	41	291	62	1	2,798	349
Ohio	601	134	268	192	7	2,929	581
Indiana	300	140	16	143	1	1,810	253
Illinois	895	510	2	383	0	2,596	1,005
Kentucky	291	120	55	115	1	1,794	334
Michigan	367	108	17	181	61	2,111	366
Kansas	1,175	568	200	397	10	3,224	947
Neb., Mo., Iowa	3	0	0	3	0	715	8
Oklahoma	1,998	1,044	150	787	17	3,098	1,240
Texas	4,328	2,776	259	1,284	9	4,542	3,955
North Central	1,370	777	23	562	8	3,033	1,420
West	1,039	884	17	138	0	4,813	823
Panhandle	210	106	89	15	0	3,223	173
Eastern	243	120	33	89	1	5,434	367
Gulf Coast	731	457	51	223	0	6,517	883
Southwest	735	432	46	257	0	5,080	289
Louisiana	614	377	40	197	0	5,702	649
Northern	318	179	30	109	0	3,276	353
Southern	296	198	10	88	0	8,977	296
Arkansas	136	74	6	56	0	4,502	90
Mississippi	226	146	15	65	0	8,388	124
Alabama	7	2	0	5	0	3,293	7
Georgia	1	0	0	1	0	3,847	2
Florida	15	1	0	14	0	5,998	13
Montana	109	53	37	19	0	2,028	141
Wyoming	102	64	9	29	0	4,858	82
Colorado	88	64	2	22	0	5,420	65
Utah	3	0	0	3	0	7,833	2
New Mexico	268	202	28	38	0	4,630	183
California	1,011	805	28	178	0	4,391	903
Miscellaneous	0	0	0	0	0	0	11
Total 1947	15,189	8,383	1,541	4,207	1,058	3,510	.....
Total 1946	13,742	7,659	1,361	3,693	1,029	3,389	.....
Difference	1,446	724	180	514	29	.....	.....



WILDCAT COMPLETIONS, FIRST 6 MONTHS, 1947

	Comp.	Oil	Gas	Dry
New York	0	0	0	0
Pennsylvania	9	0	5	4
West Virginia	18	0	9	9
Ohio	27	0	2	25
Indiana	54	10	1	43
Illinois	215	39	0	176
Kentucky	27	7	0	20
Michigan	121	7	2	112
Kansas	173	18	12	143
Neb., Mo., Iowa	3	0	0	3
Oklahoma	399	49	12	338
Texas	865	179	45	641
North Central	267	52	7	208
West	93	14	3	76
Panhandle	4	1	1	2
Eastern	59	4	3	52
Gulf Coast	208	56	20	132
Southwest	234	52	11	171
Louisiana	124	30	7	87
Northern	49	2	3	44
Southern	75	28	4	43
Arkansas	24	0	0	24
Mississippi	42	0	1	41
Alabama	5	0	0	5
Georgia	1	0	0	1
Florida	14	0	0	14
Montana	14	2	1	11
Wyoming	27	6	2	19
Colorado	20	1	1	18
Utah	3	0	0	3
New Mexico	25	4	1	20
California	189	47	7	135
Total United States	2,399	399	108	1,892
First half 1946	2,006	286	66	1,654

DEVELOPMENT-WELL COMPLETIONS, FIRST 6 MONTHS, 1947

	Comp.	Oil	Gas	*Dry
New York	803	407	0	396
Pennsylvania	1,444	747	113	584
West Virginia	377	41	282	54
Ohio	574	134	266	174
Indiana	246	130	15	101
Illinois	680	471	2	207
Kentucky	264	113	55	96
Michigan	246	101	15	130
Kansas	1,002	550	188	264
Neb., Mo., Iowa	0	0	0	0
Oklahoma	1,599	995	138	466
Texas	3,463	2,597	214	652
North Central	1,103	725	16	362
West	946	870	14	62
Panhandle	206	105	88	13
Eastern	184	116	30	38
Gulf Coast	523	401	31	91
Southwest	501	380	35	86
Louisiana	490	347	33	110
Northern	269	177	27	65
Southern	221	170	6	45
Arkansas	112	74	6	32
Mississippi	184	146	14	24
Alabama	2	2	0	0
Georgia	0	0	0	0
Florida	1	1	0	0
Montana	95	51	36	8
Wyoming	75	58	7	10
Colorado	68	63	1	4
Utah	0	0	0	0
New Mexico	243	198	27	18
California	822	758	21	43
Total United States	12,790	7,984	1,433	3,373

*Incl. service wells. See separate tabulation.

fornia 64, and Kansas 46, to account for 321 of the 393 total. Louisiana and Illinois, which with the states previously mentioned, make up the six leading producers, had small decreases in wildcat completions, four and six respectively.

The names of the individual fields or areas in which drilling was most active, as measured by total number of wells completed during the first half of 1947, are listed below.

Texas Gulf Coast: Lolita, Refugio-Heard, Saratoga, Sugar Valley, and Tom O'Connor.

Southwest Texas: Charlotte, Kelsey Deep, La-Gloria, Seeligson, and Tijerina-Canales.

Eastern Texas: Marion County Shallow, Quitman, Carthage, Talco, and Hawkins.

West Texas: Keystone, Fullerton, TXL, Levelland, and Sharon Ridge.

Southeast New Mexico: Drinkard, Paddock, Caprock, Brunson, and Grayburg-Jackson.

North Texas: Archer County, Electra, Benson, Woodbine, and Wilson.

West Central Texas: Parrott, Escota, Jones, Lewis-Steffins, and Murphree.

Southern Louisiana: Charenton, Egan, Port Barre, Tepetate, and Tepetate West.

Northern Louisiana: Caddo, Delhi, Monroe Gas, Big Creek and South, Lake St. John.

Mississippi: Brookhaven, La Grange, Baxterville, Gwinville, and Mallalieu.

Arkansas: Wesson, Village, Buckner, Spirit Lake, and Midway.

Oklahoma: Cotton County, Hugoton, Tatums, Garvin-McClain counties Deep Area, and Velma.

Kansas: Hugoton, Trapp, Kraft-Prusa, El Dorado, and Chase.

Illinois: Browns Area, Allendale, Clay City Consolidated, Herald, and Concord.

Western Kentucky: Poole-Tunnell Hill-New Cairo area, Cane Run, Griffiths, Dixie, and Guffie.

Indiana: Mt. Carmel area, Princeton area, New Harmony South, Springfield North, and Dodds Bridge.

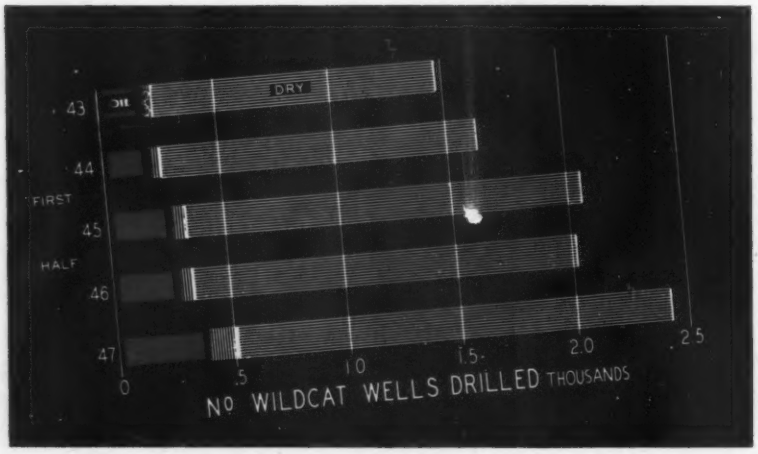
Michigan: Kimball Lake, West Monterey, Coldwater, Rockford, and Stony Lake.

Ohio: Sandyville - Canton, Brush Creek-Zanesville, Cambridge, Ashland-Lorain, and Stewart.

Colorado: Rangely.

Wyoming: Frannie, Hamilton, Big Muddy, Byron, and Garland.

Montana: Kevin-Sunburst,



Cut Bank, Bowdoin, Cedar Creek, and Cat Creek.

California: Wilmington, Cymric, Lost Hills, Ventura Avenue, and West Newport.

Results of Wildcatting

The expanded 1947 wildcat campaign was a greater success, statistically at least, than in either 1946 or 1945. Of the total exploratory wells, 21.1 per cent found either oil or gas this year, compared to 17.5 and 16.2 per cent in 1946 and 1945. The increase in successful gas wildcats was remarkable, and probably reflects the growing demand for that fuel and a more general appreciation of the profit possibilities in gas production. The total gas successes jumped to 108 this year from 66 and 64 in the two previous years. Percentagewise the increase was even more remarkable; 4.5 per cent of all wildcats drilled found gas, as compared to 3.2 and 3.1 per cent in the two previous years. The percentages for successful oil tests were 16.6 in 1947, 14.3 in 1946, and 13.1 in 1945. Whether the quality of these discoveries will be sufficient to maintain and expand proven reserves remains to be seen.

SUMMARY OF SERVICE WELLS, FIRST 6 MONTHS, 1947

State or area—	Jan.	Feb.	March	April	May	June	Total
New York	52	65	61	71	75	72	396
Pennsylvania	91	86	82	96	98	102	555
West Virginia	0	0	1	0	0	0	1
Ohio	0	1	0	1	1	4	7
Indiana	0	0	1	0	0	0	1
Kentucky	0	0	0	0	1	0	1
Michigan	13	0	0	3	26	19	61
Kansas	0	3	1	1	4	1	10
Oklahoma	2	0	0	3	4	8	17
Texas	0	0	2	3	4	0	9
North Central	0	0	2	2	4	0	8
Eastern	0	0	0	1	0	0	1
Total 1947	158	155	148	178	213	206	1,058

SUMMARY OF DISTILLATE WELLS, FIRST 6 MONTHS, 1947

State or area—	Jan.	Feb.	March	April	May	June	Total
Oklahoma	0	0	0	1	1	5	7
Texas	4	9	19	11	18	11	72
Eastern	0	0	0	2	4	1	7
Gulf Coast	3	9	12	7	11	10	52
Southwest	1	0	7	2	3	0	13
Louisiana	6	7	7	7	7	7	41
Northern	4	1	1	1	4	4	15
Southern	2	6	6	6	3	3	26
Arkansas	1	0	1	0	1	0	3
Mississippi	1	2	2	2	3	3	13
Total 1947	12	18	29	21	30	26	136

TOTAL U. S. WELL COMPLETIONS—BY MONTHS FIRST HALF 1947 VS. FIRST HALF 1946

	All wells		Wildcats		Field wells	
	1947	1946	1947	1946	1947	1946
January	2,587	2,193	442	330	2,145	1,863
February	2,261	1,990	365	278	1,896	1,712
March	2,454	2,481	383	379	2,071	2,102
April	2,280	2,270	324	315	1,956	1,955
May	2,823	2,424	457	342	2,366	2,082
June	2,784	2,590	428	399	2,356	2,191
Total	15,189	13,948	2,399	2,043	12,790	11,905

Increase of 50 Per Cent Seen in Global Oil Output

(Continued from page 173)

Francaise des Petroles (the French partner in I.P.C. which at first objected to the expanded Aramco partnership) dropped its suit against Jersey Standard and Socony-Vacuum partly on the understanding that such a pipe line will come into being.

Probable use of the airborne magnetometer in certain Middle East areas is becoming more and more apparent. Currently, Iraq Petroleum is studying how this latest exploratory instrument can be effectively utilized in Tripoli, Syria, Qatar, and the Basrah concession in southern Iraq. Meanwhile, seismic surveys are being planned on the island of Cyprus in the Mediterranean Sea this summer. An associate company of I.P.C. obtained a 75-year exploratory and development concession last May for all of Trans-Jordan. Airborne magnetometer surveys got under way in April over a 50,000-80,000-sq.-mile area in the Bahamas.

Central Europe

Petroleum production activities throughout most of Central Europe continued to be hampered by the lack of cooperation on the part of the Soviets. In some areas, notably Austria and Hungary, Russian management continues to be responsible for overproducing the fields. Only within the last few weeks have the Russians "consented" to discuss the legal ownership of the rich Zisterdorf fields much of which the Nazis acquired through duress. In Hungary and Romania the outlook is black although a late report from Romania stated that the government doesn't plan to establish control over petroleum activities although industrial cartels presumably will be established by the government over most other industries.

Elsewhere in Europe the past 6 months saw a wildcat well spudded in on the Oliana structure in Spain's Lerida province. To date there is no production in that country. In Turkey, Max W. Thornburg, foreign oil consultant, is completing a survey of that country's natural resources.

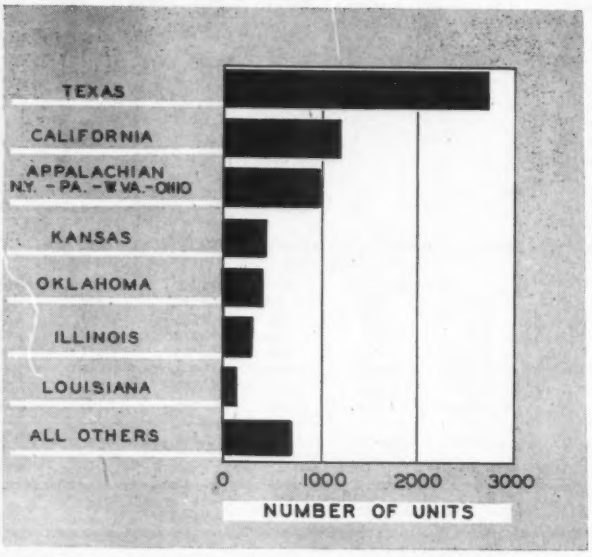
Latin America

In Latin America, Creole Petroleum Corp. pushed its daily average crude output to 599,192 bbl. in February, a new all-time high. Meanwhile proved reserves in Venezuela are being discovered faster than crude is being produced. Proved reserves in the world's second largest oil-producing country are reported to exceed 7,500,000,000 bbl.

In Peru a field trip, which may prove the forerunner to large-scale oil-industry operations east of the Andes, got under way in May with university and American Museum of Natural History geologists commencing a 4-month study in the highest levels of the Andes. Through a special grant by four oil companies results of this expedition will be studied closely.

Elsewhere in Latin America exploratory and development activities are progressing at as rapid a pace as availability of oil equipment will permit. The political situation in many countries is being watched and studied continually.

More Than 8,000 Wells Will Go On Pump in Last 6 Months



OIL producers expect to put 8,230 wells on the pump during the last half of 1947, and will require 6,953 new units net to handle their requirements during this period. They report that they put 6,615 wells on the pump during the first half. If their forecasts of their last-half requirements are accurate, this will mean 14,485 wells going on the pump during the entire year. New equipment requirements appear to stay consistently close to 85 per cent of the wells going on pump for the United States as a whole.

The unexpectedly large demand for oil and the resultant enlarged drilling program that has taken place already, and which is scheduled for substantial stepup in the last half, is reflected in the estimates of the number of wells to go on the pump. Last December, the producers forecast they would put 13,120 wells on the pump during 1947. Their 6-months actual plus last-half estimate, indicates they will increase their original figure by about 13 per cent. This is about in line with what would be expected from the larger drilling program.

Texas, as usual, leads in the number of wells to go on the pump and in number of new units required. For the last half of this year, California will take second place, running ahead of the Appalachian area of New York, Pennsylvania, West Virginia, and Ohio. For the year as a whole, however, the Appalachian area will hold second place.

Kansas in Fourth Place

Kansas is still in fourth place, slightly ahead of Oklahoma, as far as new units required are concerned, although Oklahoma has more wells put on the pump, during both the first and last halves of the year. Illinois maintains sixth place in new requirements, followed by Louisiana. All others combined account for only about 11 per cent of the new units required.

The tight crude and products situation predicted in the Illinois-Indiana refinery marketing territory for this winter may not be fully reflected in these forecasts of pumping-unit requirements.

THE OIL AND GAS JOURNAL PUMPING SURVEY

	Wells on pump first half 1947	Wells to go on pump last half 1947	New pump units required last half 1947	Per cent of new units last half 1947	Est. total wells to go on pump all 1947
Arkansas	84	128	118	1.7	212
California	916	1,050	1,170	16.9	1,966
Colorado	65	75	75	1.1	140
Illinois	420	430	302	4.3	850
Indiana	105	100	88	1.2	205
Kansas	436	483	431	6.2	919
Kentucky	77	41	37	0.5	118
Louisiana	90	204	161	2.4	294
Northern	73	121	81	1.2	194
Southern	17	83	80	1.2	100
Michigan	17	122	91	1.3	139
Mississippi	25	41	52	0.7	66
Montana	52	90	73	1.1	142
New Mexico	58	114	101	1.4	172
New York	407	422	400	5.8	829
Ohio	77	186	93	1.3	263
Oklahoma	690	656	410	5.9	1,346
Pennsylvania	747	700	445	6.4	1,447
Texas	2,242	3,219	2,760	39.7	5,461
Eastern	376	537	419	6.0	913
North Central	850	665	585	8.4	1,515
Gulf and Southwest	508	1,380	1,222	17.7	1,888
Panhandle	51	77	72	1.0	128
West	457	560	462	6.6	1,017
West Virginia	41	44	40	0.6	85
Wyoming	63	120	101	1.4	183
Miscellaneous	3	5	5	0.1	8
Total United States	6,615	8,230	6,953	100.0	14,845

Five New Major Fields Needed To Maintain Reserves

by Charles J. Deegan

ALMOST 60 per cent of all the oil ever found in the United States has come from less than 1 per cent of all the fields ever discovered. These same few fields contain today over 63 per cent of all the proven reserves of the country, and in the first half of this year, accounted for over 50 per cent of production.

The generally used figure as to the number of oil fields found in this country since the beginning is around 15,000. Yet the list of major fields, each of which will ultimately produce 100 million barrels or more, adds up to only 105, or less than 1 per cent. On an average, any individual major field is most likely to produce around 250 million barrels. This figure is arrived at by eliminating the giant East Texas field from the list, since its 5-billion-barrel ultimate yield stands out as a major exception to the trend.

In view of all the research work going on, both fundamental into the origin and accumulation of oil, and applied work at improving the finding rate, this list takes on added significance. Whatever it is that nature requires as prerequisite conditions for the accumulation of a lot of oil, in this small number of fields, those conditions were present. In what vital respect does each one of these fields differ from the 99 other fields that produced oil, but not 100 million barrels?

Chances of Finding Major Fields

This year, if past averages hold, the industry must find five new major fields, just to replace the current demand. This is because it will require the finding of about 2 billion barrels in 1947 to maintain reserves. In the past, 60 per cent of our oil has come from major fields. Therefore in 1947 we need 60 per cent of 2 billion barrels, or 1,200,000,000 bbl. from major fields. Since these major fields average about 250 million barrels, it will require five of them in 1947 to maintain past relationships. The remaining 750 million can come from smaller fields to be discovered this year.

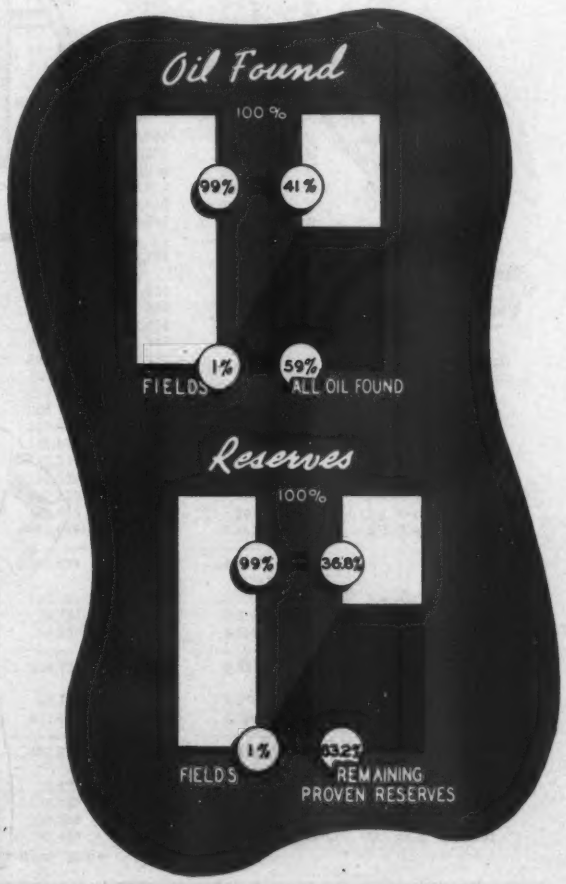
What are the chances of finding five major fields in 1947? Wildcatting is running around 5,000 plus tests per year. Of these, something like 30 per cent will be extension tests to existing fields, leaving around 3,500 plus tests looking for new fields. In 1945-46, according to the A.A.P.G. report by Lahee, an average of 15 per cent of such tests were successful. On this basis, 1947 wildcats should find around 525 new fields of all sizes. If 1 per cent of these are ultimately found to be major fields, we have our five major fields that are necessary in 1947.

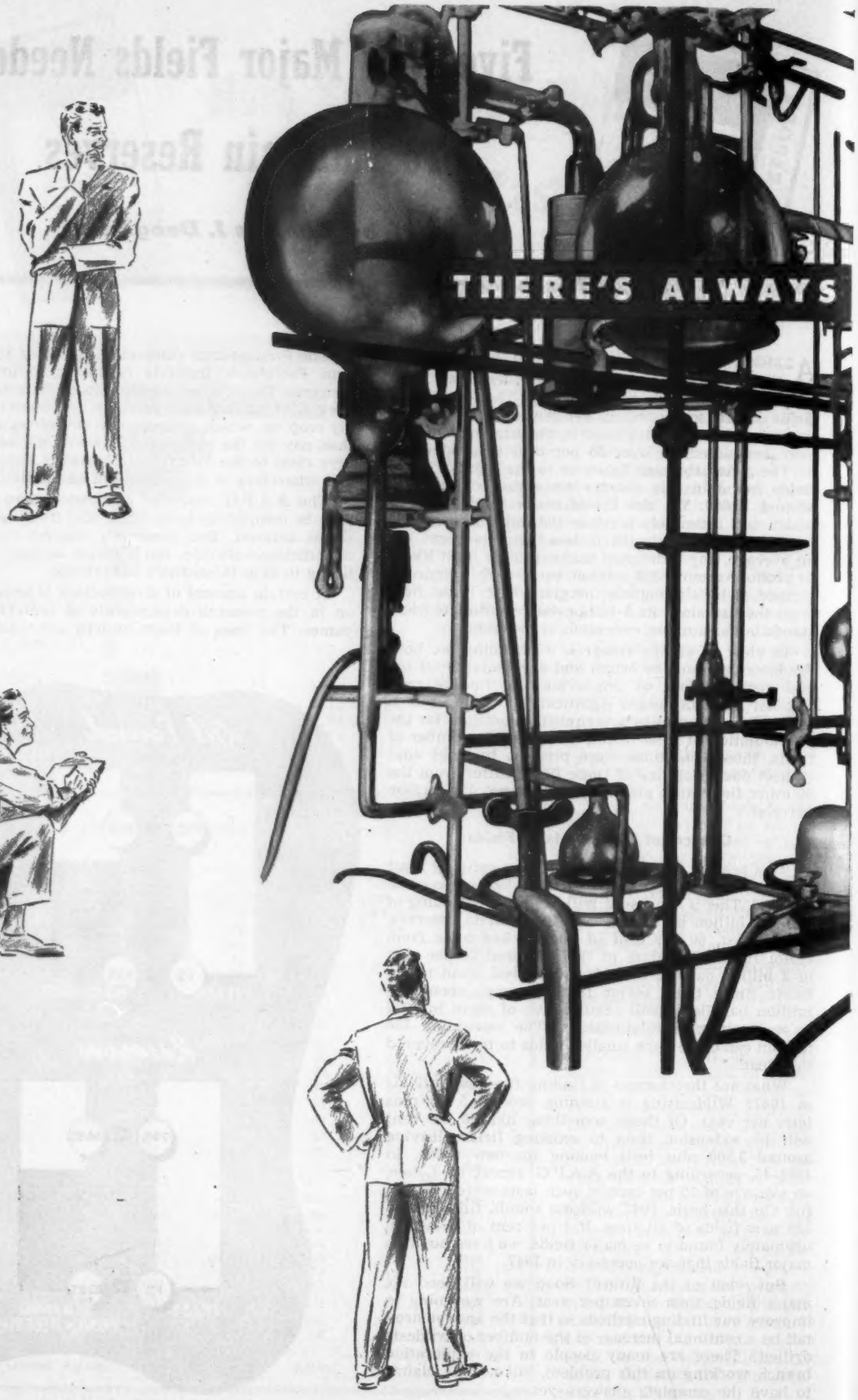
But what of the future? Soon we will need six major fields, then seven per year. Are we going to improve our finding methods so that the answer need not be a continual increase in the number of wildcats drilled? There are many people in the exploration branch working on this problem, but no one claims to have the complete answer—yet.

The fundamental research program of the American Petroleum Institute continues to make slow progress. There is no question about its continuance, because if nothing else, valuable byproducts continualy crop up, which undoubtedly will ultimately more than pay for the projects. But we do not seem to be very close to the fundamental answers as to the why and wherefore of the origin and accumulation of oil.

The A.A.P.G. research committee's projects will soon be completely formulated, and financial support seems assured. But these are indirect approaches, nonetheless valuable, but indirect in that they are filling in gaps in scientific knowledge.

A certain amount of direct attack is being carried on in the research departments of individual companies. The lines of these attacks are naturally not




THERE'S ALWAYS

public property. Obviously, however, it would be a very practical type of problem for such units to work along the lines of attempting to determine differences between ordinary-sized accumulations of oil and major fields.

The accompanying table does not settle the question of whether we are finding major oil accumulations as often as we did in the past. For the sake of uniformity, it shows the date of first oil discovery, which is not always the date of discovery of the major oil accumulation.

It does show that 38 fields were discovered prior to 1921. In the next 5-year period 13 were discovered; from 1926 to 1930, 21 were found; from 1931 to 1935 only 12; from 1936 to 1940 there was a jump to 16. Of the war years, 1942 is credited with one, 1943 and 1944 with two each. None of the 1945 or 1946 discoveries are rated as major fields, as yet.

MAJOR FIELDS* VS. TOTAL UNITED STATES RESERVES AND PRODUCTION

(In thousands of barrels)

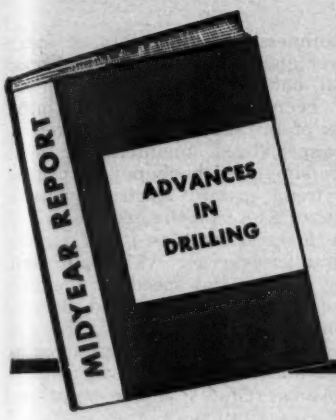
State and field—	Year of first discovery	Est. ultimate prod.	Remaining reserves 7-1-47	Cumulative prod. to 7-1-47	Prod. first half 1947	Prod. first half 1946	Main pays, sand (S) or lime (L)	Geologic age of main production
CALIFORNIA:								
Buena Vista	1909	430,000	91,232	338,768	8,428	7,258	S	Plio.
Coalinga, East	1900	325,000	68,939	256,061	2,869	3,190	S	Plio.-Mio.
Coalinga, Nose	1938	380,000	250,724	129,276	10,597	10,033	S	Eocene
Coalinga, West	1900	185,000	25,363	158,637	1,221	1,273	S	Plio.-Mio.
Coles Levee, North	1938	105,000	70,694	34,306	2,969	2,743	S	Mio.
Elk Hills	1919	445,000	249,060	195,940	1,309	2,230	S	Plio.-Mio.
Kern Front	1925	107,000	43,172	63,828	1,812	2,286	S	Plio.
Kern River	1899	330,000	34,172	295,828	1,776	1,798	S	Plio.
Kettleman North Dome	1928	440,000	109,368	330,632	6,791	6,954	S	Mio.-Eocene
McKittrick-Cymric	1887	143,000	35,755	107,245	2,434	2,008	S	Plio.
Midway-Sunset	1901	820,000	106,993	713,007	7,807	6,835	S	Plio.-Mio.
Mount Poso	1926	156,000	61,611	94,389	3,655	3,109	S	Mio.
Rio Bravo	1937	100,000	59,396	40,604	2,281	2,456	S	Mio.
Santa Maria	1903	232,000	51,857	180,143	4,257	2,407	S	Plio.-Mio.
Santa Maria Valley	1934	170,000	90,212	79,788	5,194	6,199	S	Mio.
Ventura Avenue	1916	510,000	181,475	328,525	8,410	8,402	S	Plio.
Brea Olinda	1889	223,000	32,645	190,355	2,115	1,922	S	Plio.-Mio.
Coyote, West	1909	195,000	43,338	151,662	2,745	2,810	S	Plio.
Dominguez	1923	235,000	64,481	170,519	2,752	3,031	S	Plio.-Mio.
Huntington Beach	1920	535,000	148,056	386,944	8,929	8,480	S	Plio.-Mio.
Inglewood	1924	200,000	41,650	158,350	2,203	2,429	S	Plio.-Mio.
Long Beach	1921	805,000	82,872	722,128	4,308	4,834	S	Plio.-Mio.
Montebello	1917	173,000	25,793	147,207	1,389	1,826	S	Plio.-Mio.
Richfield	1919	132,000	25,854	106,146	1,212	1,359	S	Plio.
Santa Fe Springs	1919	567,000	52,575	514,425	2,965	3,060	S	Plio.-Mio.
Seal Beach	1926	142,000	34,301	107,699	2,046	1,799	S	Plio.-Mio.
Torrance	1922	152,000	30,505	121,895	1,509	1,589	S	Mio.
Wilmington	1935	707,000	363,328	343,672	22,762	18,581	S	Plio.-Mio.
Subtotal		8,944,000	2,475,821	6,468,179	126,845	120,501		
ROCKY MOUNTAIN AREA:								
Cut Bank	1926	103,000	49,346	53,654	1,993	2,239	S	L. Cret.
Elk Basin	1915	220,000	188,544	31,456	2,898	2,459	S	Pa.
Lance Creek	1918	115,000	39,219	75,781	2,030	2,453	S	Jur.-Pa.
Oregon Basin	1927	158,000	117,262	40,738	2,027	2,006	S-L	Cret.-Pa.
Rangely	1902	250,000	233,431	16,569	4,929	3,037	S	U. Cret.-Pa.
Salt Creek	1908	377,000	52,390	324,610	2,244	2,321	S	
Subtotal		1,223,000	680,192	542,808	16,121	14,585		
OKLAHOMA:								
Avant	1904	105,000	6,958	98,042	334	371	S	Pa.
Bowlegs	1926	135,000	7,749	127,251	550	601	S	Pa.-Sil.-Dev.-Ord.
Burbank	1920	310,000	44,067	265,933	2,054	2,470	S	Pa.
Cushing	1912	405,000	29,694	375,306	1,348	1,381	S-L	Pa.-Ord.
Earlsboro	1924	135,000	4,701	130,299	325	804	S	Pa.-Sil.-Dev.-Ord.
Fitts	1933	115,000	10,647	104,353	640	810	S	Pa.-Sil.-Dev.-Ord.
Glenn Pool	1905	250,000	17,974	232,026	1,269	1,188	S	Pa.-Ord.
Healdton	1913	225,000	20,473	204,527	1,182	1,191	S	Pa.-Ord.
Hewitt and West	1919	113,000	8,412	104,588	838	846	S	Pa.-Ord.
Little River	1927	131,000	11,353	119,647	689	718	S	Pa.-Ord.
Oklahoma City	1928	700,000	52,656	647,344	4,796	5,385	S	Pa.-Ord.-Wilcox
St. Louis	1927	180,000	10,462	169,538	671	791	S	Pa.-Sil.-Dev.-Ord.
Seminole City	1926	150,000	12,430	137,570	842	971	S	Pa.-Sil.-Dev.-Ord.
Tonkawa	1921	130,000	6,135	123,865	196	207	S	Pa.-Ord.-Wilcox
West Edmond	1943	180,000	114,013	65,987	7,481	14,255	L	Sil.-Dev.-Hunton
Subtotal		3,284,000	357,724	2,906,276	23,017	31,989		
KANSAS:								
El Dorado	1916	225,000	30,809	194,191	1,384	1,303	L	Pa.-Ord.
Silica	1931	100,000	25,291	74,709	2,550	2,425	L	Pa.-Ord.
Trapp	1939	145,000	55,367	89,633	5,695	5,303	L	Pa.-Ord.
Subtotal		470,000	111,467	358,533	9,629	9,031		
ARKANSAS:								
Magnolia	1938	100,000	51,835	48,165	2,323	2,376	S-L	Jurassic
Smackover	1922	460,000	46,951	413,049	1,986	1,954	S	Jur.-U. Cret.
Subtotal		560,000	98,786	461,214	4,289	4,324		
LOUISIANA:								
Delhi-Big Creek	1944	160,000	147,523	12,477	4,920	1,483	S	U. Cret.
Caddo	1905	190,000	15,552	174,448	1,010	921	S	U. and L. Cret.
Erath	1940	100,000	78,494	21,506	3,560	3,440	S	Ter.-Mio.
Haynesville	1921	125,000	32,573	92,427	1,508	1,685	S-L	U. and L. Cret.

(Continued on next page)

MAJOR FIELDS* VS. TOTAL UNITED STATES RESERVES AND PRODUCTION (Continued)

State and field—	Year of first discovery	Est. ultimate prod.	Remaining reserves 7-1-47	Cumulative to 7-1-47 prod.	Prod. 1947 first half	Prod. 1946 first half	Main pays, lime (L) sand (S) or	main production Geologic age of
LOUISIANA (Continued)								
Jennings	1901	125,000	27,079	97,921	922	1,073	S	Ter.-Mio.
Rodessa	1930	100,000	10,842	89,158	907	1,823	L	Cret.
Subtotal		800,000	312,063	487,937	12,827	10,425		
MISSISSIPPI:								
Cranfield	1943	100,000	90,391	9,609	2,495	1,996	S	Cret.
Heidelberg	1944	102,000	91,050	10,950	2,507	1,875	S	Cret.
Tinsley	1939	170,000	72,300	97,700	3,456	4,045	S	Cret.
Subtotal		372,000	253,741	118,259	8,458	7,916		
ILLINOIS:								
Bridgeport	1906	255,000	17,598	237,402	1,117	1,068		
Louden	1937	180,000	46,779	133,221	3,766	4,217	S-L	Miss.-Dev.
Robinson	1906	164,000	10,176	153,824	548	561		
Salem	1938	239,000	38,191	200,809	2,881	2,986	S-L	Miss.-Dev.-Ord.
Subtotal		838,000	112,744	725,256	8,112	8,832		
NEW MEXICO:								
Eunice	1928	150,000	65,537	84,463	2,789	2,720	L	Perm.
Hobbs	1928	175,000	57,075	117,925	1,736	1,730	L	Perm.
Monument	1934	175,000	91,427	83,573	3,163	3,290	L	Perm.
Vacuum	1929	130,000	92,962	37,038	1,967	2,025	L	Perm.
Subtotal		630,000	307,001	322,999	9,655	9,765		
EASTERN TEXAS:								
East Texas field	1930	5,000,000	2,583,698	2,416,302	58,854	61,801	S	U. Cret.-Woodbine
Hawkins	1940	450,000	380,211	69,789	8,059	6,885	S	U. Cret.-Woodbine
Mexia	1912	107,000	6,363	100,637	221	237	S	U. Cret.-Woodbine
Powell	1923	125,000	7,073	117,927	193	227	S	U. Cret.-Woodbine
Talco	1936	170,000	72,618	97,382	4,380	4,303		L. Cret.-Paluxy
Van	1929	450,000	272,168	177,832	4,935	5,317	S	U. Cret.-Woodbine
Subtotal		6,302,000	3,322,131	2,979,869	76,642	78,770		
NORTH TEXAS:								
K.M.A.	1931	185,000	70,427	114,573	3,379	4,174	S-L	Pa.-Strawn
Subtotal		185,000	70,427	114,573	3,379	4,174		
SOUTHWEST TEXAS:								
Luling-Branyon	1921	100,000	11,291	88,709	727	724	L	L. Cret.-Edwards
Subtotal		100,000	11,291	88,709	727	724		
WEST TEXAS:								
Big Lake	1923	120,000	12,780	107,220	593	657	L	Perm.-Ord.
Cowden, North	1930	165,000	103,284	61,716	4,116	4,924	L	Perm.
Fullerton	1942	225,000	198,386	26,614	5,198	5,886	L	Perm.-Dev.-Ord.
Goldsmith	1934	250,000	173,127	76,873	3,856	4,598	L	Perm.
Hendricks	1926	225,000	13,359	211,641	640	708	L	Perm.
Howard-Glasscock	1926	185,000	58,683	126,317	2,550	2,486	L	Perm.
Keystone	1930	370,000	326,515	43,485	7,244	6,961	L	Perm.-Ord.
McCamey	1925	110,000	40,742	69,258	1,655	1,617	L	Perm.
McElroy	1926	280,000	110,322	169,678	5,109	4,951	L	Perm.
Seminole	1937	130,000	94,170	35,830	3,169	3,745	L	Perm.
Slaughter	1936	480,000	378,449	101,551	8,388	11,076	L	Perm.
T-X-L	1944	150,000	137,933	12,067	6,162	1,869	L	Perm.-Sil.-Dev.-Ord.
Ward, North and Estes	1929	115,000	56,433	58,567	1,727	2,328	L	Perm.
Wasson	1936	580,000	444,758	135,242	11,890	8,771	L	Perm.
Yates	1926	640,000	317,504	322,496	7,230	6,716	L	Perm.
Subtotal		4,025,000	2,466,445	1,558,555	69,537	67,293		
TEXAS GULF COAST:								
Agua Dulce to La Gloria	1928	1,050,000	970,199	79,801	12,315	11,228	S	Ter.-Olig.
Anahuac	1935	235,000	164,046	70,954	5,188	4,965	S	Ter.-Olig.
Barbers Hill	1916	110,000	23,877	86,123	985	922	S	Ter.-Mio.-Olig.
Conroe	1931	500,000	262,123	237,877	10,654	9,834	S	Ter.-Eoc.
Hastings	1934	375,000	238,847	136,153	10,184	9,125	S	Ter.-Olig.
Hull	1918	115,000	12,148	102,852	593	658	S	Ter.-E.O.M.
Humble and Light	1904	138,000	6,866	131,134	377	389	S	Ter.-E.O.M.
Katy	1938	110,000	93,294	16,706	2,825	286	S	Ter.-Eoc.
Old Ocean	1934	215,000	188,522	26,478	2,746	3,398	S	Ter.-Olig.
Spindletop	1901	130,000	1,652	128,348	126	112	S	Ter.-Olig.-Mio.
Thompson	1931	200,000	114,822	85,178	4,918	6,078	S	Ter.-Olig.-Mio.
Tom O'Connor	1934	450,000	342,963	107,037	8,599	6,649	S	Ter.-Olig.
Webster (Friendswood)	1937	310,000	216,110	93,890	10,017	8,938	S	Ter.-Eoc.-Olig.
West Columbia	1902	125,000	23,031	101,969	1,119	353	S	Ter.-Olig.-Mio.
West Ranch	1938	165,000	121,109	43,891	3,610	3,324	S	Ter.-Olig.
Subtotal		4,228,000	2,779,609	1,448,391	74,356	66,259		
NEW YORK-PENNSYLVANIA:								
Allegany	1879	170,000	47,000	123,000	1,760	1,822	S	Pa.
Bradford	1871	591,000	92,000	499,000	5,799	5,768	S	Pa.
Subtotal		761,000	139,000	622,000	7,559	7,590		
Total major fields		32,702,000	13,498,442	19,203,558	451,133	442,158		
Total U. S. all fields to date		55,463,000	21,345,090	34,117,910	894,726	846,538		
Major fields' share of total		59.0%	63.2%	56.3%	50.4%	52.2%		

*Fields with estimated ultimate production of 100 million barrels or more.



Drilling Equipment Moves Steadily Toward Goal of Reduced Hole Costs

by Neil Williams

A REVIEW of engineering phases of drilling reveals important advancements being made both in the provision of more adequate equipment of improved types and design, and in the development of techniques for more effective and efficient operation. Through them, the industry, despite increasing costs of materials, labor, and other items, is making steady progress in its efforts to reduce the over-all costs of drilling wells.

Advancements in equipment reflect in general the trends toward greater streamlining of rigs, increased power and capacity without proportionate gains in weight and size of equipment, more effective and efficient utilization and distribution of available power, more simplified and automatic or semiautomatic control, greater safety, and reduction of crew fatigue in operation, and, so far as power rigs are concerned, a higher degree of flexibility and smoothness of hoisting speeds.

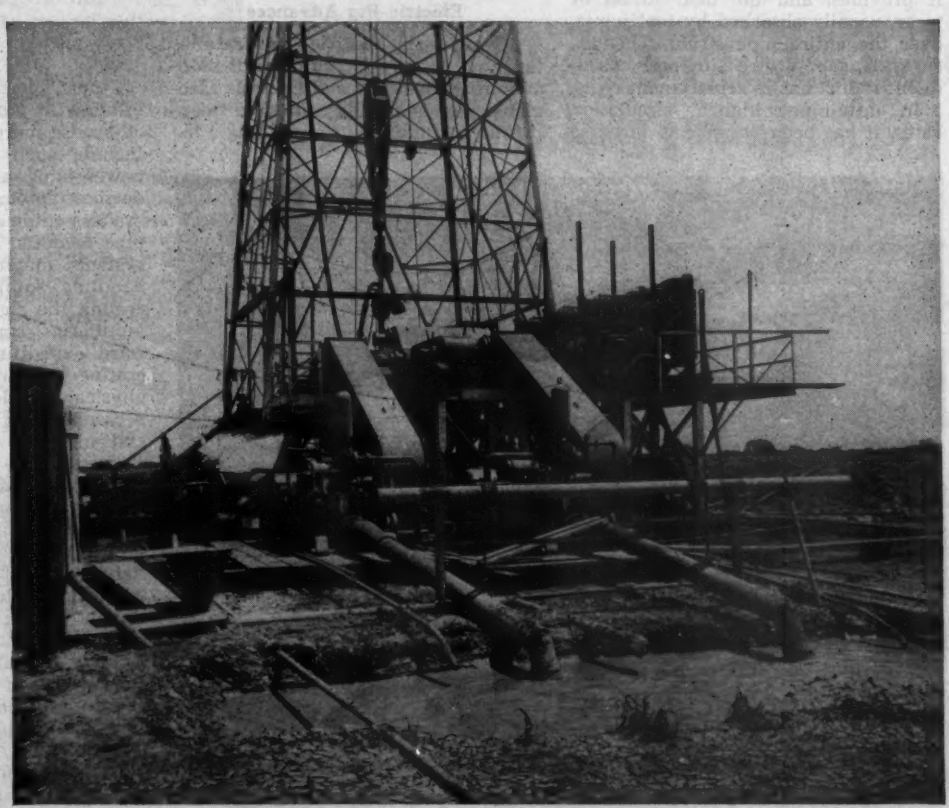
Streamlining and unitization of equipment, designed to expedite moving and setting up rigs, already has reached a point in many cases whereby further work in this direction can be accomplished only at the expense of other operations. Consequently, to effect additional savings in time and cost of moving and rigging up, increasing consideration is being given to such things as better and more efficient transportation facilities, devising more systematic moving schedules, improved roads into locations and standardization of rig layouts.

Lighter Materials, Redesign

With weight and size of certain major component parts of some of the larger rigs approaching economic and practical limits, further increases in capacity and strength of equipment for deeper drilling may have to be obtained through redesign of equipment and use of better and lighter metals and materials.

Mud pumps are of chief concern at this time so far as weight and size are concerned. With deeper drilling and trends toward higher mud-circulating rates and volumes, provision of adequate pump capacity imposes certain problems and complications, particularly on power rigs where satisfactory means of compounding pumps for higher pressures have not been perfected.

In view of the present capacity limitations in respect to weight and size of pumps now in general use, it is necessary to increase the number of pumps to give higher circulating rates and volumes. Especially in the



Modern version of streamlining and compactness as applied to deep-drilling power rigs. This rig, recently placed in operation in South Texas, includes three 325-hp. gas engines and two 10-in. pumps driven through transmission compounding unit

case of power rigs, this may become prohibitive from an economical and pump-handling standpoint.

Changes in basic pump design as a means of reducing weight and size of the individual units and at the same time increasing capacity and operating efficiency are in the making. One such advance is the comparatively recent introduction of multicylinder plunger-type pumps now being used on several rigs with favorable results.

Savings in pump-capacity requirements while attaining higher circulating rates have been effected to some extent by redesign of drill pipe and tool joints to minimize restrictions to flow of drilling fluid. Potentialities for further efforts along this line, however, appear to be exhausted.

Pump-Capacity Requirements

Important economies in pump-capacity requirements are being realized by the use of larger-sized drill pipe, which now is gaining favor particularly in deep drilling. Favored for deep wells is a change to 5-in. o.d. pipe having a wall thickness of 0.362 in. Until recently 4½-in. pipe has been in general use. Other benefits derived from the use of larger pipe lie in the greater torsional strength it provides, and the distribution of wear, usually absorbed by tool joints, over the entire pipe string. This insures longer service life and consequent reductions in replacement costs.

In attaining higher circulation rates, it has been possible to increase hole-penetration rates substantially and also reduce the chances of sticking pipe, the latter effecting important savings in possible fishing costs.

Operation of internal-combustion engine rigs is being enhanced by improved transmissions incorporating additional speeds for faster and smoother hoisting requirements, improved clutches and braking facilities with air or vacuum-operated controls, and more effective and efficient distribution and utilization of available power. Progress also is being made in development and application of hydraulic drives and torque converters which make for greater smoothness and flexibility. Engines themselves are undergoing changes in design to provide greater horsepower per pound of weight and generally higher fuel and operating efficiences. In the case of multiple diesel-engine installation the inclusion of automatic speed synchronizers, pneumatically operated, is contributing to more effective power utilization. With these improvements, wider adaptation of power rigs to deeper drilling in competition to steam and electric equipment is being made possible. Their use in comparison to steam equipment means reduced fuel requirements and greater portability features.

Electric-Rig Advances

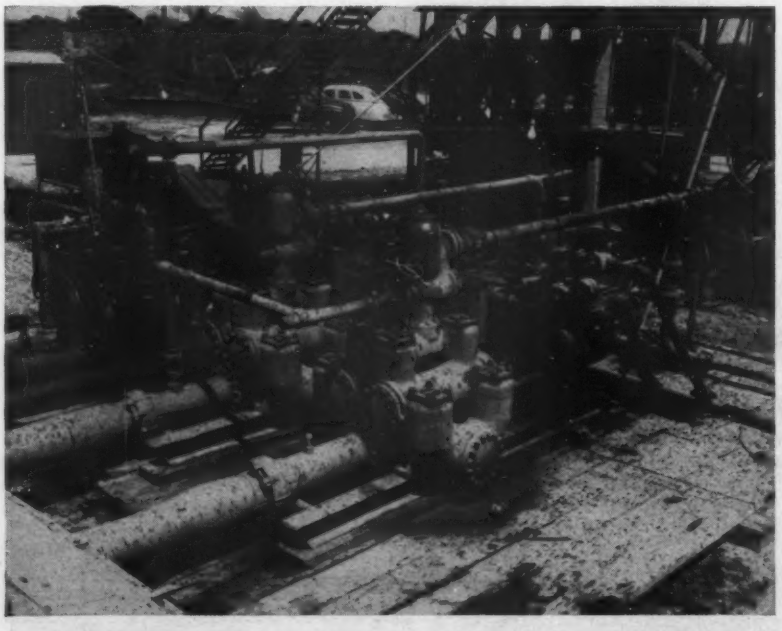
Advances in electric-rig installations are largely in the form of more simplified hookups and control. Electric power is ideally suited to deep-drilling conditions, providing the smoothness and flexibility of steam power and economies in actual operation, but with wide use of such rigs has been retarded by high initial costs of installation and requirement for specialized maintenance. With more simplified hookups and control, the trend toward electric power is increasing. A specific recent innovation for electric rigs is an electrohydraulic governor which automatically adjusts the speed of the generator engines as the load demand upon the generators varies. The governor permits the lowest possible speed under any given load demand, and thus reduces engine wear and fuel consumption.

Steam-Rig Developments

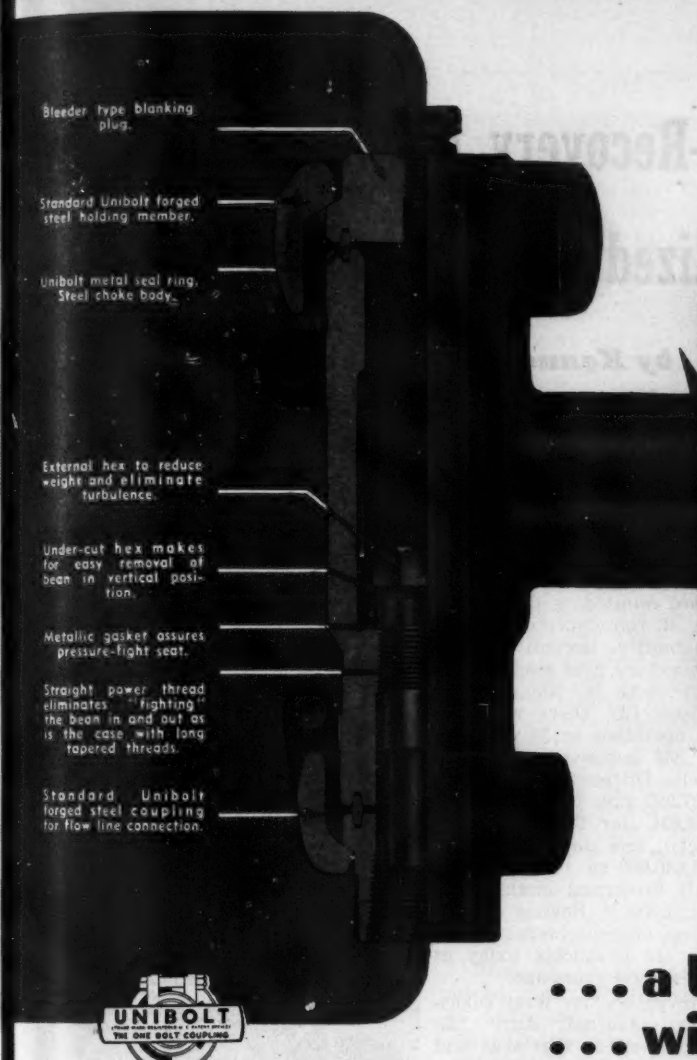
Developments in steam-rig operation are being directed to improvements in boiler design to give higher pressures and greater steam-generating capacity, economies in fuel and water consumption, and safer and more automatic control. New types of steam-saving facilities and feed-water preheaters to conserve and utilize exhaust steam are making possible economies in fuel and water consumption. Boilers of 300 and 350 psi. working pressure are common and 500-psi boilers are coming into use. Modern installations include automatic control of feed water and fuel to the boilers, automatic blowers and draft regulators, aid various safety devices.

Other special equipment coming into use to promote faster, safer, and otherwise more satisfactory operation include such items as air-operated power slips, automatic pipe-stabbing devices, automatic catheads, powered brakes, automatic and semiautomatic pipe feedoffs, intrarig-communication systems, and devices for lifting and handling equipment, pipe and tools around the rig. In many cases, these auxiliaries contribute not only toward expediting their particular operating function but also to reduce physical exertion and fatigue of crew personnel. By the latter, efficiency and alertness of the crew are increased to the extent that more and better work is performed.

Taller derricks are being designed and finding increasing use on the deeper wells to permit pulling longer stands of drill pipe and thus reduce trip time. Maximum height of a standard A.P.I. derrick has been 136 ft. Derricks having a height of 178 ft., a water table opening of 5½ ft., and a base of 32 to 37 ft. now are being provided on many oil wells. One having a height of 185 ft., a water table opening of 6 ft. 8 in., and a 40-ft. base is being designed. The latter will be capable of pulling fourbles of 36-ft. pipe or thribles of 45-ft. pipe. Larger bases are providing greater floor space and thus facilitate handling of pipe and other work.



Mud-pump installation on deep drilling steam rig on Gulf Coast, employing two 20-in. and one 16-in. pumps. Small pump normally is used for mixing and auxiliary service. Hookup is such any of pumps can be operated singly, in parallel, or in compound in any combination for any purpose


Bleeder type blanking plug.
Standard Unibolt forged steel holding member.
Unibolt metal seal ring. Steel choke body.
External hex to reduce weight and eliminate turbulence.
Under-cut hex makes for easy removal of bean in vertical position.
Metallic gasket assures pressure-tight seat.
Straight power thread eliminates "fighting" the bean in and out as is the case with long tapered threads.
Standard Unibolt forged steel coupling for flow line connection.

This is a BUSY BODY

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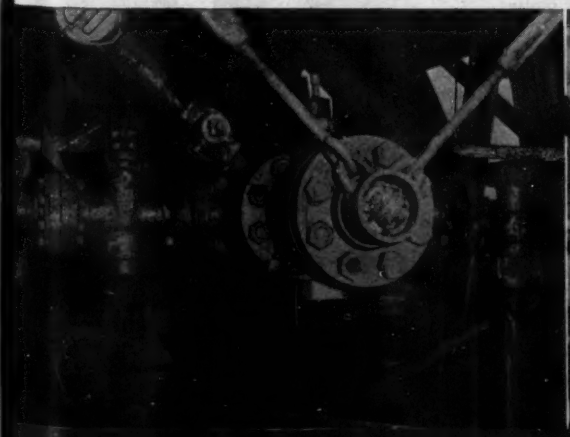
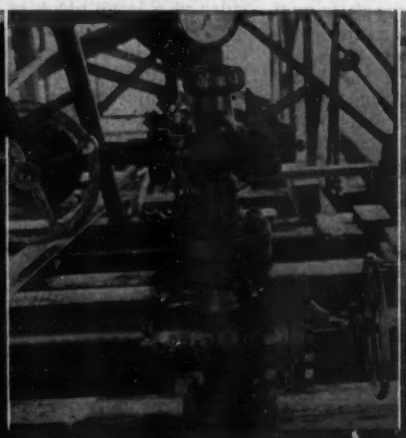
A UNIBOLT Choke Body fitted with a UNIBOLT positive bean is your best bet for controlling high pressure well flow or the return of mud when it is necessary to close the preventers and bleed off well pressure through a flow line. Both flow conditions are often highly abrasive and it is in this service that UNIBOLT chokes have so often demonstrated their superiority.

Replace the positive bean with a stem seat and insert a stem assembly in place of the blanking plug and you have a UNIBOLT Adjustable Wing Valve which many operators are now using in Christmas tree manifolds to provide a shut-off for changing chokes.

The UNIBOLT Choke Body is available flanged, as illustrated, in pressures up to 15,000 lbs. test, ~~open hub~~ threaded inlet in 6000 and 10,000 lbs. test pressure, tee or cross type. It will accommodate either UNIBOLT beams drilled in increments of 1/64" or "X" Beans drilled in increments of 10% of well flow. Both types of beans are drilled to extremely close tolerance and are heat-treated to produce minimum hardness of 60 Rockwell C. Hard chrome beans are available for extremely abrasive service.

THORNHILL-CRAVER COMPANY, INC. Houston, Texas





Improved-Recovery Advances Aided by Specialized Equipment and Tools

by Kenneth B. Barnes

PETROLEUM engineers today, as midyear 1947 rounds the turning point, are stretched out in almost innumerable specialized activities. These, for some, are in the laboratory. Many more important jobs are in the field—dealing with well completions, flow, gas lift, and pumping equipment, gas-and-oil handling systems and storage, applications of improved producing methods.

Secondary oil recovery today is more than being talked about—field after field in different sections of the country is reporting new projects to start and extensive additions to older programs. The shift to injecting gas and water to new fields right from the start, instead for the most part allowing straight pressure depletion to run its course, also in 1947 is continuing to increase. And unitization, a most desirable part for both secondary and primary recovery programs, has received much new publicity and tangible action this year.

Better Methods Increase Recovery

On equipment, advances and improvements similarly continue. Some are comparatively "hidden"—such as better steels and material specifications, modifications in design, more standardization, and the like. Others are new "tools" for the petroleum engineer in his specialized work. For example, an oil-well camera is now in use which can photograph a well bore continuously or for any preselected interval. Spinner and well flow-meter surveys are available which go down the hole and record the relative flows of gas and liquids as they may come in from different depth positions. Still others are "lease" equipment, such as a new electrical well-control system. This provides electrically actuated valves on the wells, and on the tankage, to "produce" the property virtually automatically. A central control and switch panel are set up for the wiring. On lifting, long-stroke hydraulic pumping units are coming into the picture—with strokes up to 20 ft. and operating at six to eight or so strokes per minute. Reported advantages are lower peak loads and less stress.

Repressuring.—Surprising, when the totals are counted, is the growth in number of repressuring projects across the country. Recently such a count, or inventory, was made of the gas-drive projects in North Texas (Journal, April 12). There were 214 projects in operation in 20 counties. These had 838 gas-input wells and 5,165 oil wells. Oil production was in excess of 37,000 bbl. per day. Acreage was 29,894 (for 57 per cent of total projects), and daily gas injection was 35,630,000 cu. ft. (for 82 per cent of total). Producing depths range from 200 to 4,000 ft. Review of production curves of some properties revealed they are producing today as much oil as several years ago.

Another inventory, for West Texas-New Mexico (Journal, April 12), showed 15 projects in that area and proposals under way for such operations in 9 other fields. The latter include some big pools: Fullerton, Keystone, Slaughter, and Vacuum.

Something new in repressuring, too, is under way in Silica pool of western Kansas. Here Stanolind Oil & Gas Co. will use nitrogen for injection purposes. About $100,000 is reported to be spent on the project, and construction of the nitrogen-manufacturing plant is already under way. The gas will be compressed and fed into the producing formation on two sides of a large block of wells.

Cycling.—A Journal survey of cycling activities just completed shows total liquid-hydrocarbon output of these plants now is nearly 4 million gallons per day (July 19 issue). Two large units The California Co. is building in Louisiana and Mississippi will shove the total nearly to 4.5 million, as their estimated daily production capacity is over 11,000 bbl. The 4-million-gallon-daily lineup at present covers 24 independent companies with 2.25 million gallons per day capacity, and 12 majors with 1.75 million gallons capacity. This is equal to one-third the capacity of all the country's natural-gasoline plants.

What cycling does in the way of re-

Newer Engineering Tools

1—Preliminary inspection of cores. They then will go to a truck laboratory, or be quick-frozen and/or sent to fixed-base laboratories for complete analyses

2—Examining electric log. Today these are run on nearly every well drilled

3—Inserting detonator in sonic-type fluid-level meter. This method tells if pumping wells are getting maximum production

4—Geophone set up on well completion to indicate if and when nitro shot goes off

5—Electrolytic model of Lake St. John condensate reservoir. Best "sweep patterns" for the dry gas injection will be found

6—Pool analyzer provides future trends of water-influx and reservoir pressures

(Photos courtesy The Carter Oil Co.)

covery as against straight pressure depletion was shown earlier this year in a paper on such calculations (Journal, January 4). The gain was 19,400,000 bbl. of pentanes and heavier condensate for field data of 19,250 acres, 27-ft. sand thickness, and a reservoir gas content of 3.04 g.p.m. of C-5s and plus. Again, in the Benton unit of Louisiana, estimates indicate a recovery of 91 per cent of the liquids in place, against 57 per cent by normal depletion (Journal, January 11).

A new mobile laboratory for gas-condensate studies and evaluation made its appearance this year (Journal, April 26), and field layouts to apply cycling and gas-injection below the normal gas-water contact were described (Journal, May 3). For the latter, in one condensate field cited seven injection wells are completed for this type of injection. In another (Katy) eight are in proven service. Furthermore, the practice is being employed in three other smaller gas-condensate pools in South Texas. By this development, slightly off-structure dry holes can be made to "count," saving much additional injection-well capital investment. Probably more important, however, is the greater sweep and flushing of the reservoir made possible. Cycling fundamentals also were outlined in a series of reservoir-engineering reports by the U. S. Bureau of Mines (Journal, February 1, 8, and 15).

Pressure maintenance. — Drawing-board work and engineering studies to determine feasibility of pressure maintenance now starts nearly currently with discovery of new fields. In reviewing the first half of production progress in 1947, this approach can be described as now becoming "standard practice." Outlines and background for such studies have been given for West Texas (Journal, January 11). As for pressure-maintenance results, the 6-year history of Rincon field was reviewed (Journal, May 24), an operation where 15 million feet of gas per day at up to 2,000 psi. is injected into five different sand reservoirs. Ninth compressor unit is added this year, up from the two 600-hp. units in the original 1941 installation.

Smaller pressure-maintenance installations for the limited-size pools is another newer trend. Richard King field in South Texas has a 3-million-cubic-feet-per-day, 2,000-psi. plant (Journal, February 15); Williams pool in West Central Texas has a new 2-million, 1,000-psi. pressure-maintenance plant (Journal, July 5). This latter plant has extensive automatic controls (oil production is 400 bbl. per day), and the plant operates without anyone in attendance from 8 p.m. each evening until the next work day.

Water flooding.—For years oil producers and research institutions have been searching for a method to exclude water selectively from sand strata, as they become "watered out" under the effect of flooding operations. The most promising materials applied were dispersions of solids in water. In new laboratory and field tests, Dresinol, an emulsion of a resin-like product, was investigated as a plugging medium. Methods recently have been devised to determine the selectivity of the procedure in the field. Results of several operations at Bradford and other fields where this emulsion was applied have shown good results (see Journal, April 19). For 77 water-input wells treated, changes were:

INTAKE RATE

Before treatment		After treatment	
Average B/D	Average specific B/D per ft.	Average B/D	Average specific B/D per ft.
196	4.75	85	2.1

Interesting factual case histories of water-flooding projects, giving core data, operational detail, costs, recoveries, etc., have appeared this year. Three Mid-Continent projects were analyzed in one paper (Journal, April 26), one of which involved 2,700,000 bbl. reserve by flooding. In Throckmorton County, Texas, three waterflood projects similarly were analyzed (Journal, April 12). All look well upon the profit side.

One of the large new deep waterflood developments, that in Haynesville field of Louisiana and Arkansas, now has started into its second year, with over a million barrels of water injected at 1,150 psi. surface pressure so far (Journal, June 21).

Bacterial action.—Latest oil-recovery mechanism to be unfolded is that which may be possible through bacterial action (Journal, June 21 and 28). The ideas behind this future potential method of oil production, or in obtaining additional recovery might be expressed: "Certain strains of bacteria have the power to strip an oil film from around the outer surface of a sand grain, apparently by physically shouldering it out of the way and crowding themselves so tightly packed around the grain that oil is displaced."

Gas conservation.—All told, midyear 1947 finds natural gas being conserved in the oil fields as never before. It is not talk, today. New plants are going up. Take some figures for Texas that have been released (Journal, May 10). Fifteen projects completed, conserving 101 million cubic feet per day, involve an investment of $11,427,000. There are 10 projects under construction, to conserve 174 million feet, that are costing $40,813,000. And 44 projects are planned, to conserve 485 million feet, for which investment amounts to $75,090,000.

A-C ENGINES
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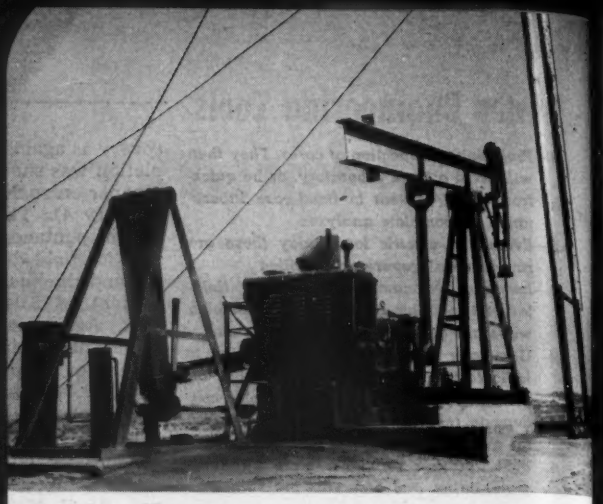
Allis-Chalmers power engine units are slow-speed, high torque, prime movers with cooling and lubricating systems built to maintain proper operating temperatures on full load stationary installations regardless of outside temperatures. They do not have to be run at high speeds to secure proper cooling, as the engine blocks have large water capacity and the moving water first cools the hottest part of the engine. Water pumps are high velocity impeller type.

Fuel and oil bills won't increase in hot weather on Allis-Chalmers Engines.

A-C Model L Engine 590 ft. lbs. torque
A-C Model E Engine 400 ft. lbs. torque
A-C Model U Engine 200 ft. lbs. torque
A-C Model W Engine 128 ft. lbs. torque
A-C Model B Engine 87 ft. lbs. torque

Write for complete specifications



Two well hook-up powered by a smooth running A-C Model U Engine. Torque 200 ft. lbs. It really gets hot in West Texas.

Allis-Chalmers Model E Engine on a heavy well in Oklahoma. Model E torque is 400 ft. lbs. Continuous operating range 600-1200 r.p.m.

Allis-Chalmers Model L Engine with 590 ft. lbs. torque. This engine drives a 5" x 10" pipe line pump.

Billion-Dollar Expansion Program Scheduled by Nation's Refiners

by R. B. Tuttle

RECENT surveys by The Oil and Gas Journal indicate that $450,000,000 or more has now been specifically allocated and scheduled for capital investment in the nation's refineries for 1947 and 1948. But that is not all—the aggregate, it recently has been indicated—may be $1,100,000,000 plus (see the Journal, June 28, page 75).

Up to the end of the first half of this year some $450,000,000 have been earmarked for expenditure by a large number of companies. Expansion in refining capacity resulting from these expenditures ranges all the way from an increase of a "few hundred barrels" up to 40,000 or more barrels per day for the plants affected, with an over-all average at slightly above 30,000 bbl. Reports reflect that around 60 per cent of this approved-money figure is slated for the large plant, according to the survey. A large share of the balance of the money approved for expenditure on specific projects is shown to be scheduled for expanding and improving the refineries having capacity ratings upwards of 25,000-30,000 bbl. for crude and comparable cracking throughputs. About 1 per cent of the programs scheduled as of July 1 will be in those plants having cracking facilities and crude-oil-charging capacities within the range of 5,000 to 8,000 bbl., or less, per day.

Small and Medium Plants

Division of the 450 million earmarked dollars among new construction, enlargement of existing facilities, revamping, and maintenance repairs for the small refinery operating at 5,000 to 8,000 bbl., or less, crude-charging capacity, averages as follows:

	Per cent
New construction	13
Enlargement	8
Revamp	70
Repairs	6

Of the foregoing divisions or classifications each is indicated as being split up further into a 65-35 ratio in favor of processing facilities over auxiliary equipment such as storage, loading racks and docks, central pump stations, and electrical and steam-generating layouts. The 35 per cent figure for auxiliaries appears to be relatively higher than ordinary for conditions involving plant revamping, but when taking into account the fact that such expenditures on this type of equipment, over the past 6 or 8 years have been practically nil, the entire figure seems to be justified.

Expressed in dollars, new construction in the small refineries is indicated to run in the order of $720,000, currently. With the releasing of unallocated money the figure is expected to grow to $1,800,000 before long. Enlargement of existing equipment involves expenditures of about one-half of the amount scheduled for new construction and the expenditures on repairs is indicated to run slightly under one-third of that amount. Revamping, the big end of the spending schedule for the small refineries, will use up more than 3 million dollars of the money currently allocated and an additional 4¾ million is expected to be set aside for such work when the balance of the money scheduled for

Ethyl Corp. has announced plans to spend $20,000,000 to enlarge manufacturing facilities at its plant at Baton Rouge, already the largest of its kind in the world. Additions will be made to the tetraethyl lead area (left), to the sodium operations (center), and to the ethyl chloride installations (right)

Four reasons why

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TABLE 1—NEW CONSTRUCTION AS REPORTED BY 49 COMPANIES
(Daily throughput—Barrels 42)

Refining district	Capacity expected to begin operating in 1947 2nd Q.	1947 3rd Q.	1947 4th Q.	1948 1st Q.	1948 2nd Q.	1948 2nd half	1949 1st half	1949 2nd half
1	.....	.....	.....	.....	.....	7,000	40,000	5,000
2	.....	23,000	.....	23,000	.....	†43,000	50,000	7,000
3	4,000	20,000	.....	20,000	12,000	.....	35,000	.....
4	2,000	6,000	.....	2,000	.....	3,900	9,000	.....
E. of Calif.	6,000	49,000	.....	45,000	12,000	53,000	134,000	12,000
5	6,000	‡90,000	.....	.....	.....	.....	.....	.....
Total U. S.	12,000	‡139,000	.....	45,000	12,000	†53,000	134,000	12,000

*As reported by Fred Van Covern at twelfth midyear meeting, A.P.I. Division of Refining, St. Louis, June 23, 1947. †Includes 85,000 said to be for replacement. ‡Includes 15,000 said to be for replacement.

A 165-ton fractionating tower, 117 ft. long and 16 ft. in diameter, for catalytic cracking unit at Sugar Creek plant of Standard Oil Co. (Indiana) near Kansas City

A scheduled $4,000,000 modernization program is on at Continental Oil Co.'s Denver plant, partial view shown here. Capacity will be more than doubled to process 8,000 to 10,000 bbl. daily, a cat cracker added, new gas plant installed

the industry's 1947-48 expansion program is allocated to specific projects.

In the medium-plant range the breakdown on type of work planned for the 2-year period averages out approximately as follows:

	Per cent
New construction	22
Enlargement	47
Revamp	21
Repairs	10

The splitup on the above runs to slightly different ratios from that for the smaller plants. For example, the portion of money allocated to expenditure on equipment employed directly in process operation is nearly one and one-half times that set aside for auxiliaries. In general the ratio is 60-40.

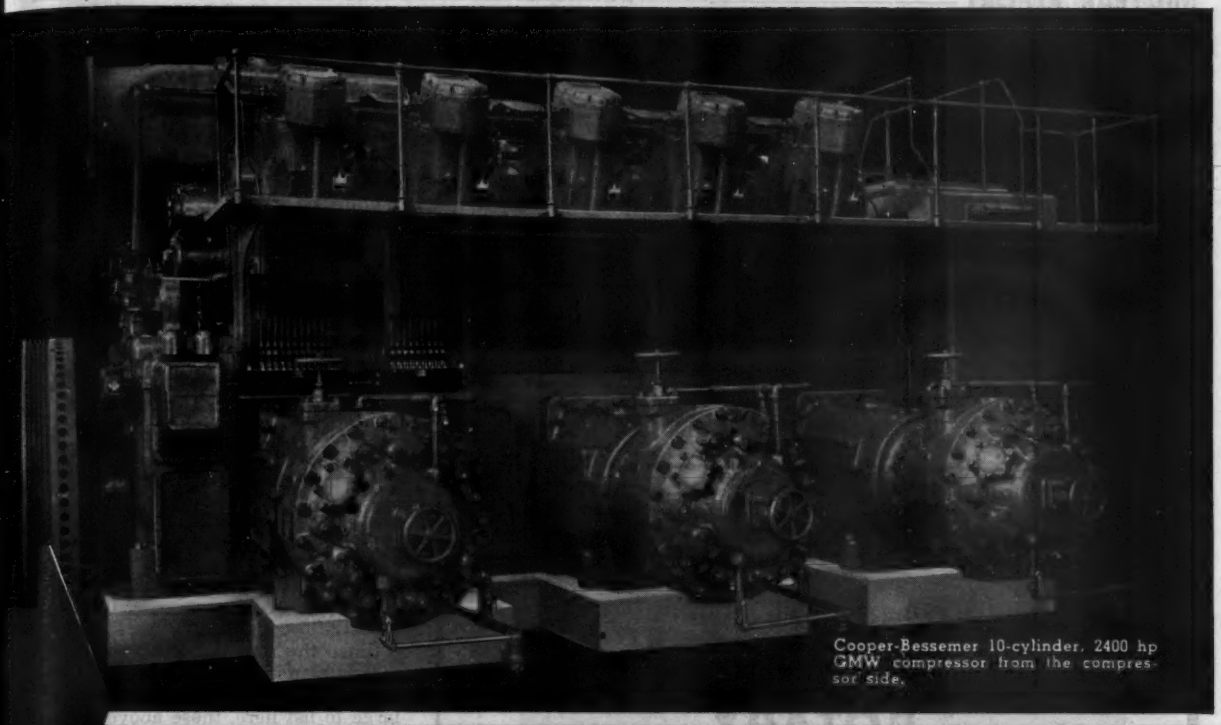
Much of the work planned and under way for the medium-capacity refineries involves enlargement of existing processing facilities and their auxiliaries which in dollar value is around $82,500,000. New construction on processing units only, comes to approximately $23,200,000 and auxiliaries for these units to around $15,400,000 for a total of $38,600,000. This figure is indicated as increasing to the 100-million bracket when the unallocated 60 per cent or balance of the 1.1 plus billion is made available. In contrast to the small-refinery building program the medium plant is scheduled to spent more than 100 times as much as is indicated for the small plant on enlargement of existing facilities. In round figures the amount totals up to $82,500,000 for the medium-capacity refineries. Some of the expenditures scheduled to be made under new construction will be for new refineries, one of which is well toward completion at this time and the others headed for completion in mid 1948 and by the end of 1949.

Large Refineries

The large refineries, those in the 30,000 to 40,000-bbl.-per-day and over capacity range, come in for the major share of the allocated 450 million dollars and doubtless the same ratio will hold or even be upped when the balance of the 1.1 plus billion is earmarked for given projects. How the money is expected to be divided by work classification in the representative large refinery is as follows:

	Per cent
New construction	40
Enlargement	30
Revamp	18
Repairs	12

The divisions in processing facilities and their auxiliaries on the foregoing large-refinery work-classification breakdown averages out nearly equal. Aside from probable new plants in this capacity range which may be constructed before 1950, the 50-50 ratio indicates a trend towards improvement in production efficiency by the addition of new and the en-



Cooper-Bessemer 10-cylinder, 2400 hp GMW compressor from the compressor side.

Cooper-Bessemer 10-cylinder, 2400 hp GMW compressor from the operating side.

by **Cooper-Bessemer**

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largement and revamping of existing equipment and buildings supplementary to those engaged directly in manufacture. In addition to the large sums set aside for such construction that may fall in the category of the foregoing, other large sums are scheduled for such items as storage of both crude and finished and semifinished products, facilities for shipping and receiving, and intraplant transportation of products and other materials. Disposal systems for handling plant effluent water and waste byproducts are also scheduled to take up a substantial portion of the sums budgeted by several companies. On proportionate scales such improvements are indicated likewise for the medium and small refineries.

Value of new construction work approved for some 35 of the country's 55 refineries falling in the large-plant group, runs to around $108,000,000—half of which, as mentioned before, is allocated to processing facilities and the balance to auxiliary or supplementary facilities. Enlargement of existing facilities related directly and indirectly to manufacture comes to approximately $81,000,000, which figure is also shown to be divided evenly between processing and auxiliary equipment. The total money indicated as set aside for revamping and repairing comes out to the same amount as that scheduled for enlargement work. The sum allowed for expenditure in revamping is approximately one-fifth greater than that set aside for repairs the nature of which is not within the normal category of maintenance. Money allocated for expenditure by the large refineries totals some $270,000,000 and the amount of unallocated funds are indicated to be in the range of $405,000,000.

A cross-section of the industry's activity is illustrated in the following tabulation of a number of representative companies which have made public the dollar value of their expansion programs for the next few years:

Sinclair Refining Co.	$150,000,000
Socony-Vacuum Oil Co., Inc.	45,000,000
Standard Oil Co. of N. J.	26,000,000
Standard Oil Co. of Ohio	10,000,000
Cities Service Oil Co., Delaware	18,000,000
Mid-Continent Pet. Corp.	3,500,000
Humble Oil & Refining Co.	5,600,000
Tide Water Associated Oil Co.	3,000,000

Since the number of all companies which plan to expand their refining facilities in the near future is too large to list here, those above are believed sufficient to indicate the magnitude of the program.

Capacity Expansion

By 1950 the rated capacity, on a crude-oil-charge basis, of the nation's approximately 400 refineries will be well upwards of 6,000,000 bbl. per day, according to available information. Current capacities on active plants are near 5,400,000 bbl. per day with slightly more than 160,000 bbl. per day for shutdown plants. A.P.I. figures of capacities are scheduled to increase by 307,000 bbl. per day at the end of 1949 by virtue of new construction, and another 100,000 bbl. per day through replacement (see accompanying Table 1). Possibly some of the 100,000-bbl.-per-day figure given by the A.P.I. may be the result of reopening one or more of the shutdown refineries during the current expansion program, but in any event if the figure along with that shown as the rated capacity on shutdown plants is disregarded relative to increased refining capacity by 1950, capacity ratings will still be more than 5,700,000 by the end of 1949.

At current ratios of crude-oil charging to cracking capacities of the 89 per cent of plants which operate cracking facilities, nearly 200,000 bbl. per day of cracking capacity may be installed before 1950. This figure of course includes both thermal and catalytic processes, and on a basis of new construction of processing facilities, averages out in favor of the catalytic methods. The ratio of catalytic to thermal cracking is currently in the order of slightly more than 1 to 3 in favor of the thermal operations. By

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the end of 1949 this ratio may change to 5 to 12 or even 1 to 2.

Conversion of existing thermal units to catalytic units is being studied seriously by a large number of the operators in the medium and small-refinery group and even some consideration is indicated by a few operators in the large-plant group. Extensive studies by several companies on the economics of such conversions show a wide spread of figures which when averaged lend no assistance in solving all problems because most of the factors involved are of local nature. A study on conversion from thermal to catalytic cracking using all of the existing thermal equipment possible shows that a particular 15,000-20,000-bbl.-per-day (crude charge) refinery could be equipped with 5,000-bbl.-per-day converted unit at approximately $100 per barrel of crude charge. Charge to the particular catalytic unit under consideration was on the basis of virgin gas oil at the 5,000-bbl. rate or at a total charge rate of around 7,000 bbl. per day. The company which made this study is scheduled to spend considerable money on expansions and improvements but to date, apparently, it has reached no decision regarding the conversion. Recently another refinery, rated at approximately one-half of the crude-charging capacity of the other plant, has placed in operation its converted unit. Reports reveal operational results are highly satisfactory with production rates and quality exceeding expectations. This unit has a capacity rating of around 60 per cent of the 5,000-bbl.-per-day unit considered in the study by the other company.

Types of Processes

Units for the preparation of catalytic feed stocks are expected to come in for a good share of the 1947-48 building program. Indications are that coking, vacuum, and deasphalting processes have been selected and are being considered for many refineries wherein such processes may be required for balancing operations. Various types of product-treating processes are also indicated as taking a substantial share of the 1.1 plus billion dollars. In fact, the program includes nearly every kind and type of modern refining process available commercially today along with a huge amount of associated facilities and auxiliary equipment.

In the natural-gasoline and gas-conversion and processing field, expenditures under the 2-year program are indicated to be substantial. The major money, some $30,000,000 plus, is reported at this time to be slated for two gas-conversion plants. A survey on the status of these projects indicates much of the money allocated to them is yet to be spent. Information on natural gasoline and other types of natural-gas processing plants shows that building activity will keep abreast with natural-gas production. Specific projects known to be under way or approved for construction run into several million dollars.

Even with the uptrend in refined-product demand being met by 1950, the refinery operator may still be confronted with the demand problem then just as now. However, reliable predictions indicate the mid-century problems will involve product quality as greatly as product quantity. In the event these predictions materialize by the time 1950 arrives the 1.1 plus billion stands to be upped possibly to $1,500,000,000.

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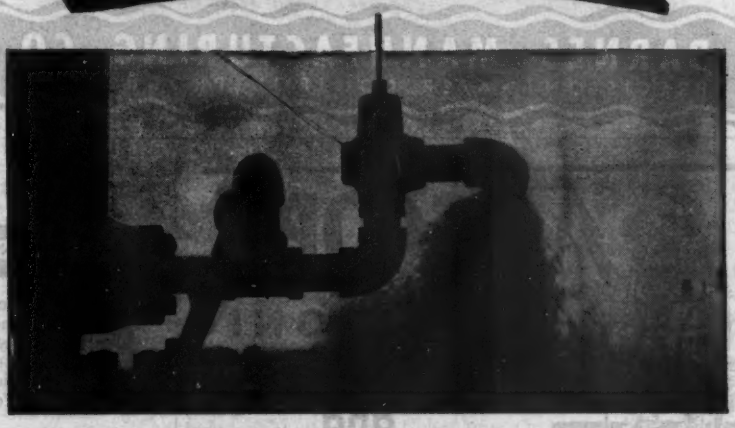

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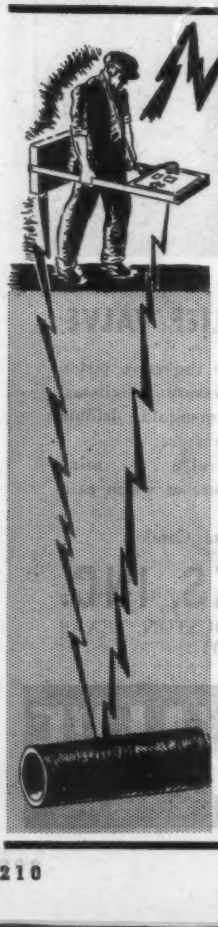

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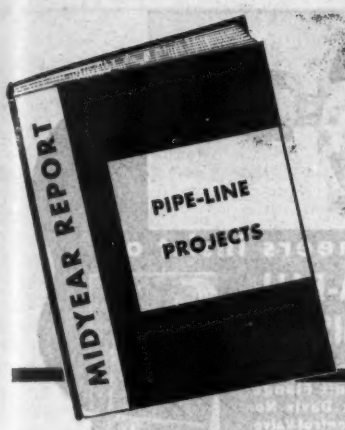

28,000 Miles of Pipe Line Announced for 1947-49

by Paul Reed

WITH more construction work in sight than ever before, the pipe-line industry is spreading huge programs over the 1947-1949 period. For this interval a total of approximately 26,800 miles of line have been definitely announced by major companies. Of these, 21,600 miles are to be built in the United States. They include 6,600 miles for crude oil, 5,200 miles for products, and 9,800 miles for natural gas. Major foreign lines contemplated total 5,200 miles.

In the face of difficulties in obtaining pipe, the end of the first half of 1947 finds more construction already completed or under way than for the first half of a normal year. It is notable that three separate active 1947 big-inch projects alone—Magnolia Petroleum Co.'s 20-in., Stanolind Pipe Line Co.'s 20-in., and El Paso Natural Gas Co.'s 26-in., together with Pacific Lighting Corp. group's 30-in.—total 1,782 miles.

Big-inch and still bigger-inch pipe characterizes the 1947-1949 period. While natural-gas lines of 24 and 26-in. have been laid extensively for some time, crude-oil pipe lines did not go above 12-in. until the war period. In 1947 activities, approximately 1,700 miles of 20-in. crude-oil lines are completed, under way, or definitely on the boards. Even a further step forward is being taken, following the laying of the first high-pressure 30-in. gas line in California this year. For pipe of 30 and 31-in. diameter is contemplated for Middle East crude-oil construction. And serious consideration is being given to laying 36-in. pipe for certain future projects.

New Equipment and Methods

New equipment and methods improve construction and operation of the modern lines. The first commercial centrifugal compressor installations ever made on natural-gas lines are to be made this year by Texas Eastern Transmission Co. and Tennessee Gas & Transmission Co.

The major spheres of pipe-line construction in 1947-49 may be classified by certain strategic areas to be served such as: the Great Lakes-St. Lawrence refining areas; West Texas oil fields; the Middle Western and Texas products markets; and Gulf Coast and Hugoton gas fields.

Before discussing these separately it should be mentioned that the outstanding 1947 undertaking consists of the combined Texas-California projects of El Paso Natural and Pacific Lighting organizations which pioneer pipe-line construction from the Mid-Continent to California. So large is the California demand that it may be predicted that looping operations will start soon after completion. A 1,000-mile 20-in. crude-oil line from Midland, Tex., to Wilmington, Calif., is being planned by a group headed by Shell Oil Co., Inc., interests. A natural-gas line from Barker Dome (New Mexico and Colorado) to serve San Francisco is being discussed.

To augment supplies to the Chicago-Toledo area of the Great Lakes region, Magnolia Pipe Line Co. has started laying the 650-mile 20-in. Corsicana, Tex.-Patoka, Ill., line. A 550-mile 20-in. West Texas-Cushing, Okla., crude-oil line is to be built and operated by Texas Pipe Line Co., Shell Pipe Line Corp., and Empire Pipeline Co. together. Stanolind Pipe Line Co. this year added 178 miles to the 148 miles of 20-in., laid in 1946 for the 632-mile Drumright, Okla.-Whiting loop program. In September Stanolind expects to start laying a total of 265 miles of loops between La Plata, Mo., and Manhattan, Ill., including 189 miles of 20-in. and 76 miles of 22-in. A 300-mile 20-in. line is planned by Portland Pipe Line Co. which will parallel the present 12-in. to serve St. Lawrence River refineries.

In West Texas Stanolind is postponing until fall the building of an 80-mile 16-in. extension. Gulf Refining Co. is laying 105 miles of 8 and 10-in. to loop its West Texas-Gulf Coast line. On the Gulf Coast, Texas Pipe Line Co.'s program calls for 140 miles of 20 and 22-in. from West Columbia to the Port Neches-Port Arthur area. Interstate Oil Pipe Line

TABLE 1—MAJOR DOMESTIC CRUDE-OIL PROJECTS
1947-1949 (announced)

Company—	Miles	Inch	Status	Location
Standish Pipe Line Co.	289	12	Planned	Goldsmith, Borger, Tex.
Magnolia Pipe Line Co.	650	20	Under way	Corsicana, Tex.-Patoka, Ill.
Stanolind Pipe Line Co.	197	12-16	Planned	Loops Casper, Wyo.-Freeman, Mo.
Stanolind Pipe Line Co.	....	10	Planned	Wamsutter to Casper, Wyo.
Stanolind Pipe Line Co.	178	20	Completed	Drumright, Okla.-Freeman, Mo.
Stanolind Pipe Line Co.	265	20	Planned 1947	La Plata, Mo.-Manhattan, Ill., as part of 632-mile 20-in. Drumright, Okla.-Whiting, Ind., looping program.
Utah Oil Refining Co.	200	10		Rangely, Colo.-Salt Lake City
Phoenix Pipe Line Co.	600	8	Planned	Permian basin-Phoenix
Midway Pipe Line Co.	600	..	Planned	Permian basin-Oklahoma to Kansas
Texas Pipe Line Co.	440	20	Planned	Midland, Tex.-to-Cushing, Okla.
Texas Pipe Line Co.	60	16		West Columbia, Tex.-Houston
Texas Pipe Line Co.	80	22	Planned	Houston-Port Neches and Port Arthur
Texas Pipe Line Co., Shell Pipe Line Corp., Empire Pipe Line Co.	500	20-22-24	Planned	Jal, N. M.-Cushing, Okla.
Shell and other companies	1,045	20	Planned	Midland, Tex.-Wilmington, Calif.
Gulf Refining Co.	105	8-10	Under way	Midland-Lufkin, Tex., loops
Standard Oil Co. of California	181	10	Planned	Rangely, Colo.-Salt Lake City
Portland Pipe Line Co.	300	20	Planned	Portland, Me.-Montreal
Rocky Mountain Pipe Line Co.	232	8-10	Planned	Lance Creek

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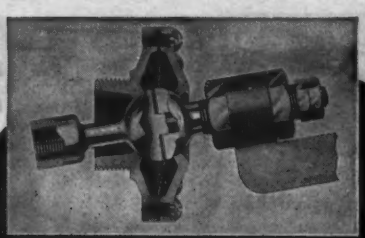

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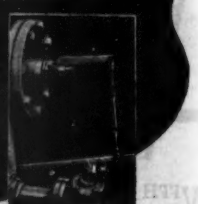

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Co. is reported to be planning a large-diameter crude-oil line from the Maysville, Okla., area to Oklahoma City.

In the Rocky Mountains both Standard Oil Co. of California and Utah Oil Refining Co. have announced plans for building lines from Rangely, Colo., to Salt Lake City. Rocky Mountain Pipe Line Co. plans extensive enlargement operations. Also to be noted is that Wyco Pipe Line Co. is building the first products line of substantial extent in the Rockies. Phillips Petroleum Co. is laying a 265-mile 6-in. Borger, Tex.-Denver products line.

The most extensive products pipeline system was announced this year by Sinclair Refining Co., which on completion of 3,000 miles will link the company's Houston, Chicago, and Marcus Hook, Pa., refineries. Large segments are being laid in the Corpus Christi-Bryan, Tex., and Clinton-Steubenville, Ohio, areas. Eventually Dallas, Fort Worth, Kansas City, and St. Louis will be served as construction progresses.

Following completion this year of the Standard Oil Co. (Indiana) 600-mile Minnesota-North Dakota products system it is logical to believe that this company will build extensive products lines in the large Middle West area it supplies.

By an interesting arrangement, a Beaumont-Fort Worth and Dallas products line is being built: Magnolia Pipe Line Co. is constructing and will operate the 178-mile 12-in. southern section, while Texas Pipe Line Co. has the building and operation of the 172-mile 10-in. northern section.

Colorado Interstate Gas Co.'s 260-mile 20-in. Lakin-Denver project is the first 1947 natural-gas line being built from the great Hugoton field. Michigan-Wisconsin Pipe Line Co. is surveying for a 1,069-mile 22-26-in. line to serve Milwaukee and Detroit, when pipe can be procured for construction. Cities Service Gas Co. plans for a 510-mile 26-in. Hugoton-Kansas City line. Mid-Continent Gas Transmission Co. has prospective plans for a line to Kansas City and St. Paul. Extensive looping of outlets from Hugoton is being carried on by Panhandle Eastern Pipe Line Co., Northern Natural Gas Co., and Natural Gas Pipeline Co. of America. United Gas Corp. has a project for building 1,500 miles to supply southeastern states from South Carolina to Florida.

For transmitting gas from the Gulf Coast gas fields to the Ohio River Valley section, Tennessee Gas & Transmission has a 910-mile looping project for which pipe is laid by a continuous program. Texas Eastern is said to be considering paralleling the Big Inch (former WEP lines) with a 30-in. line in the future.

Trunkline Gas Supply Co., headed by Ralph K. Davies, has announced plans for an 885-mile 30-in. line from Wharton County, Texas, to Keokuk, Iowa.

TABLE 2—LARGE DOMESTIC PRODUCTS-LINE PROJECTS

1947-1948 (announced)

Company—	Miles	Inch	Status	Location
Shell Pipe Line Corp.	100	6	Under way	Sheridan-Deer Park, Tex.
Standard Oil Co. (Indiana)	662	8-10	Completed	Joliet, Ill.-Moorhead, Minn., and Fargo, N. D.
Phillips Petroleum Co.	365	6	Under way	Borger, Tex.-Denver
Wyco Pipe Line Co. (Standard of Ind., Texas Co. and Socony-Vacuum Oil Co., Inc.)	267	8	Under way	Casper, Cheyenne, Wyo., Denver
Magnolia Pipe Line Co.	178	12	Under way	Beaumont-Hearne, Tex.
Texas Pipe Line Co.	172	10	Planned	Hearne-Dallas and Fort Worth area
Sinclair Refining Co.	225	6	Under way	Corpus Christi, San Antonio, Austin, Bryan, Tex.
Sinclair Refining Co.	190	6	Under way	Clinton, Cleveland, Steubenville, Ohio
Sinclair Refining Co.	850	10	Planned	Houston, Fort Worth, Dallas, Coffeyville, Kansas City
Sinclair Refining Co.	200	8	Planned	Kansas City-St. Louis (part of 3,000-mile, Houston, Chicago, Marcus Hook project)
Connecticut Pipe Line Corp.	40	8	Planned	New Haven-Hartford
Southeastern Pipe Line Co.	19	8	Completed	Link between Southeastern and Plantation systems at Doraville, Ga.

TABLE 3—PRINCIPAL DOMESTIC NATURAL-GAS PROJECTS

1947-1948 (announced)

Company—	Miles	Inch	Status	Location
Panhandle Eastern Pipe Line Co.	660	18-26	Programs Under way	Loops
Michigan-Wisconsin Pipe Line Co.	1,069	22-26	Planned	Hansford, Tex.-Big Rapids, Mich.
New York State Natural Gas Co.	155	12-16	Planned	Pennsylvania
Mid-Continent Gas Trans. Co.	400	26	Planned	Liberal, Kans.-Kansas City
Mid-Continent Gas Trans. Co.	438	22	Planned	Kansas City-St. Paul
Natural Gas Pipe Line Co. of America and Texoma Natural Gas Co.	139	26	Under way	Kansas and Nebraska loops
Colorado Interstate Gas Co.	260	20	Under way	Lakin, Kans.-Denver
Ohio Fuel Gas Co.	149	10-12-16-20	Under way	Ohio
Mississippi River Fuel Corp.	230	10-12-22	Under way	Loops Perryville, La.-St. Louis
Hope Natural Gas Co.	75	12-20		Loops
Southern Natural Gas Co.	138	20-22	Planned	Chattanooga-Lexington, Miss.
El Paso Natural Gas Co.	740	26	Under way	Eunice, N. M.-Blythe, Calif.
El Paso Natural Gas Co.	248	24	Planned	Eunice, N. M.-Dumas, Tex.
Southern Calif. Gas Co. and Southern Counties Gas Co.	214	30	Under way	Blythe, Calif.-Los Angeles
East Ohio Gas Co.	50	20	Under way	Jackson-Brook Park, Ohio
Tennessee Gas & Trans. Co.	912	20-26	Under way	Loops
Tennessee Gas & Trans. Co.	99	16	Completed	Agua Dulce-San Salvador, Tex.
Memphis Natural Gas Co.	1,000	24	Planned	East Texas-Pittsburgh, Pa.
Atlantic Seaboard and Virginia Gas & Trans.	268	24	Planned	Cobb, W. Va.-Rockville, Ind.
Manufacturers Light & Heat Co. and Home Gas	130	14	Under way	Coatesville, Pa.-Port Jervis, N. Y.
United Gas Fuel Co.	100	20	Planned	Ceredo, W. Va.-Crawford, Ohio
Northern Natural Gas Co.	133	16-24	Planned	Loops
Northern Natural Gas Co.	320	26	Planned	Palmyra, Neb.-Garden City, Kans., looping
Northern Natural Gas Co.	245	24	Planned	Palmyra, Neb.-Farmington, Minn., looping
Trunkline Gas Supply Co.	885	30	Planned	Wharton County, Tex.-Keokuk, Iowa
United Gas Pipe Line Co.	93	18	Planned	Baxterville, Miss.-Mobile, Ala.
United Gas Pipe Line Co.	33	20	Planned	Carthage-Longview, Tex.
United Gas Corp.	1,500	..	Planned	Alabama, Florida, Georgia, South Carolina
United Gas Fuel Co.	50	20	Under way	West Virginia
East Ohio Gas Co.	43	20	Under way	Barberton, Ohio
Panhandle Eastern Pipe Line Co.	660	..	Planned	Loop
Cities Service Gas Co.	510	26		Hugoton-Kansas City
Peoples Natural Gas Co.	90	..		Pennsylvania

Use of Bead Catalyst In Commercial Houdry Units

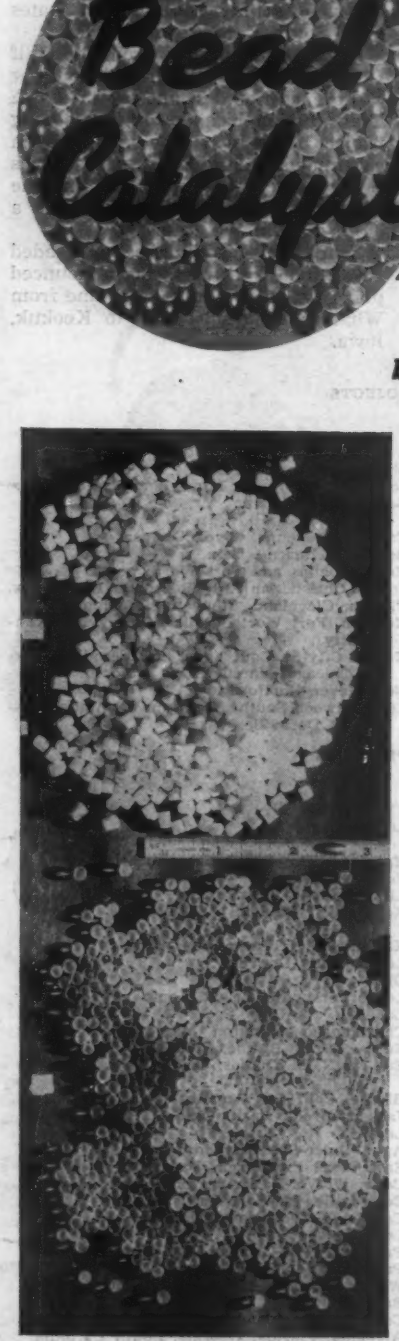
ABSTRACT

THE performance record of bead catalyst in the first year of service in commercial Houdry units, as exemplified by the Socony-Vacuum Houdry unit at Paulsboro, has been excellent. Outstanding from the operators' viewpoint, are the relative freedom from orifice plugging and the smooth regeneration characteristics, both of which should materially reduce maintenance costs.

It is estimated that a complete six-case catalyst change could be made during a routine shutdown. Alternately, the catalyst change could be made without a complete unit shutdown in 7 days.

Labor requirements for catalyst replacement would be reduced by more than 90 per cent. These improvements in the catalyst-change operation, plus the lower cost of bead catalyst, result in an increase in annual refinery profit of about $40,000 for a standard 10,000-bbl.-per-stream-day Houdry plant.

by C. V. Hornberg, E. D. Keiper and R. M. Chesney



Comparison of physical shape of Socony-Vacuum bead catalyst and Houdry synthetic catalyst

ONE of the outstanding technical achievements of the war era was the development and commercialization[1] by Socony-Vacuum Oil Co., Inc., of synthetic bead catalyst for use in catalytic cracking operations. From March 1944, when first introduced, until the end of the war, the entire production of bead catalyst was allocated for use in Thermofor catalytic cracking (T.C.C.) plants[2,3] and its use in this equipment was responsible for a large increase in the output of aviation gasoline for the war effort.

Since the end of the war, bead catalyst has become available for use in peacetime catalytic cracking operations for high-quality motor-gasoline production.[3] Because of its availability, low cost, and the other advantages which have made its continued use in T.C.C. units attractive, bead catalyst is finding wide application in Houdry fixed-bed cracking operations. It has already displaced Houdry pelleted synthetic catalyst in a number of plants.

The first commercial fixed-bed unit to convert to bead catalyst was the Houdry unit of Socony-Vacuum at Paulsboro, N. J. From the start, bead-catalyst performance in this unit has been eminently satisfactory and this quickly led to the adoption of beads for use in other Houdry units. Today, 7 of the 11 Houdry units in Socony-Vacuum plants have been converted to bead catalyst and the remaining 4 will be converted at the time of their next catalyst change.

During the course of the initial test run on bead catalyst at Paulsboro, the performance of the unit was carefully followed by operating and engineering groups to develop precise information for appraising the merits of bead catalyst in this service. The information and observations from these studies, supplemented by correlated data from comprehensive testing of bead catalyst in laboratory fixed-bed pilot plants, serves as the basis for this paper.

First Test Run

The Paulsboro Houdry unit commenced operation on bead catalyst in October 1945, when three of the six cases in the plant were placed on stream with a fresh charge of beads, while the other three were down for catalyst change.

During the initial break-in period, normal precautions were exercised and the cases were brought on stream without difficulty. It is significant that the unit was placed on automatic cycle-timer operation, i.e., partial bypassing of the feed stock and/or regeneration air around the cases was discontinued, within 5 hours after starting oil to the cases. This contrasts with periods of several days before bypassing can be discontinued in starting up on fresh Houdry synthetic catalyst. Moreover, it was possible to utilize the full air delivery of the turbo-compressor set without experiencing "wild" temperatures during the regeneration period. This maximum air rate was approximately 1.0 cu. ft. per minute per liter of catalyst, which is about twice that normally used in regeneration of Houdry catalyst at Paulsboro. Because of the higher air rate, coke burnoff rates as high as 18 g. per liter of catalyst per hour were attained with safety, compared to the usual maximum of 12-14 g., permitting a high level of conversion.

After the remaining three cases

C. V. HORNBERG

E. D. KEIPER, JR.

R. M. CHESNEY

CHARLES V. HORNBERG joined the research and development laboratories of Socony-Vacuum Oil Co., Inc., in 1930. A graduate of University of Washington, with a B.S. degree in chemical engineering, he has pioneered in both Houdry fixed-bed and T.C.C. cracking development.

Edward D. Keiper, Jr., joined Socony-Vacuum's research and development division at Paulsboro immediately following graduation from University of Pittsburgh, and has been associated with processing problems related to fixed-bed catalytic cracking and thermal cracking.

R. M. Chesney came to Socony-Vacuum in 1934, and since 1940 has been general foreman over the alkylation, thermal cracking, Houdry, T.C.C., stabilizers, and gas-recovery units in the Paulsboro refinery. He is a graduate of University of Delaware, with a B.S. degree in chemical engineering.

were charged with bead catalyst in March 1946, all six cases were operated in a six-case cycle until November 1946, when the first three cases were taken off stream for catalyst change. This type of operation was very satisfactory and it was possible to maintain coke burnoff rates of 12-14 g. per liter of catalyst per hour. There was no evidence of residual carbon buildup on the catalyst and consequently no necessity for a catalyst cleanup regeneration period at any time. This was proven during a routine shutdown for plant inspection after 8 months of operation. When the cases were subjected to extended blowing with air, there was negligible rise in catalyst temperature or CO_2 formation.

Ease of Catalyst Removal

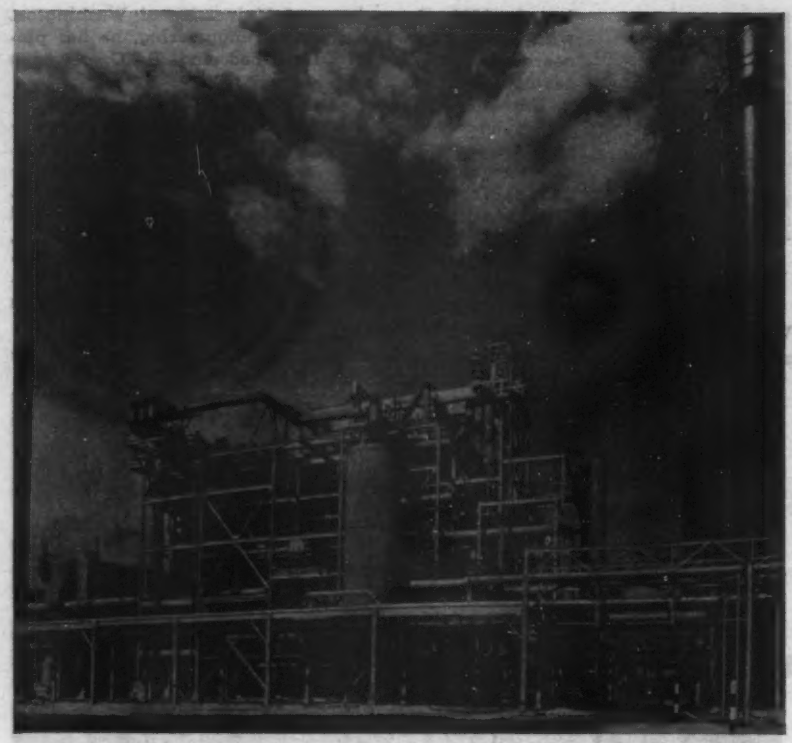
In November 1946, the first three cases of beads to go on stream (October 1945) were shut down for catalyst change, representing an actual on-stream catalyst service of 8,948 hours. The cases were cool and opened in the usual manner and a number of vapor inlet or "RT" tubes were removed from the catalyst tube sheet to permit the catalyst to discharge from the cases down through the vapor inlet or "snake" tubes.

The ease of removal of the beads from the cases exceeded expectations. The average time required to empty a case after 13 months service was 8 hours, and this was accomplished with only 10-15 tubes (RT's) removed from each case. There was no bridging or holdup of the beads between the tube fins, and the flow of the beads from the cases was actually dependent on the speed of removal of the tubes. By contrast, the discharge of Houdry synthetic catalyst normally requires removal of all the RT tubes and vibration of the remaining tubes with air hammers in order to dislodge packed and agglomerated catalyst masses. These operations involve considerably more time and labor than was required for the bead catalyst.

The second set of three cases was shut down for catalyst change in February 1947, after 6,911 hours of on-stream service. In view of the ease with which the bead catalyst was re-

Fig. 1—Top tube sheet after year of cracking over bead catalyst at Paulsboro

Fig. 2—Top level of bead catalyst in reactor case of Paulsboro Houdry unit



View of Socony-Vacuum Oil Co.'s Houdry unit at Paulsboro

moved from the first three cases, a simpler technique for changing catalyst was tried on one case of the second set. Holes were cut through the case shell and liner, just above the catalyst tube sheet, to act as catalyst discharge ports. The bulk of the beads flowed freely from the case and that remaining on the tube sheet was removed by air lancing through these ports. Thus, the beads were discharged from the case without removing any of the tubes.

On the basis of the success of this technique, it is conservatively estimated that a conventional Houdry case could be completely emptied of beads in 24 hours or less without opening the case. Obviously, this would greatly reduce the turnaround time required for catalyst replacement. It is the opinion of the authors that a complete six-case catalyst change (changing three cases at a time) could be made in 7 days when using bead catalyst in conventional Houdry cases, compared to a minimum time of about 40 days (20 days per three cases) required for discharging Houdry synthetic catalyst. The savings in labor requirements would be even more striking, amounting to about 3,800 man hours per case, or a reduction from about 4,000 to an estimated 200 man hours.

Moreover, it may be possible to make these quick catalyst changes during scheduled shutdowns for cleanup and inspection of the unit, whereby no loss in gasoline production would be attributable to the catalyst-change operation.

Inspection of the cases showed them to be in excellent condition after an entire year of bead service. Orifices and shields on the tubes removed from the cases were relatively clean. It is estimated that not over 10 per cent of the ports were obstructed to any appreciable extent. Some scale was evident but in no case was loss of metal serious enough to warrant replacement of any of the tubes. The case liners were all in good condition and no evidence of dangerous overheating was detectable.

The aged catalyst removed from the cases contained only a small amount of fines, proving the mechanical stability of the beads. There was no accumulation of catalyst dust on the top tube sheets, such as that which this plant has experienced when using the pelleted catalyst. Fig. 1 shows the clean condition of one of the tube sheets after removal of the tube sheet grid.

The free flowing character of bead catalyst is reflected in the uniform top level of the catalyst in the cases. Fig. 2 is a view of one of the cases after removal of the top tube sheet showing the beads evenly distributed and flush with the top of the tubes.

Product Yields and Quality

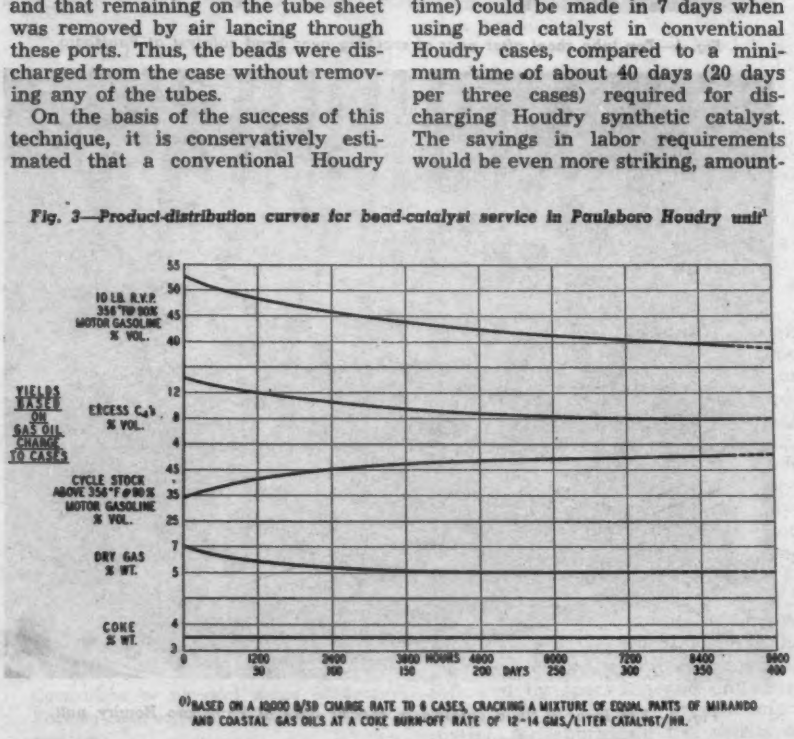
An important phase of this first plant test of bead catalyst was the accurate evaluation of yields and quality of the products. This was accomplished by special yield surveys which were conducted at suitable intervals over the entire 13-month period of the operation, representing about 12 months of on-stream catalyst service. The individual surveys were made during test periods in which the same stock, a naphthenic gas oil, was charged at a fixed rate; cracking conditions were adjusted according to normal practice to compensate for aging of the catalyst. These adjustments involved increasing the temperature and pressure to the extent permitted by the coke-burning limit of the unit, which was about 12-14 g. of coke per liter of catalyst per hour when operating all six cases.

The yields obtained from these surveys are plotted in Fig. 3 as a function of catalyst age. Properties of the gas oil charged during the survey periods are shown in Table 1. The yields shown in Fig. 3 are based on a charge rate of 10,000 bbl. per stream day to the cracking cases.

It will be noted from Fig. 3 that

(Continued on page 242)

Fig. 3—Product-distribution curves for bead-catalyst service in Paulsboro Houdry unit[1]



[1] BASED ON A 10,000 B/SD CHARGE RATE TO 6 CASES, CRACKING A MIXTURE OF EQUAL PARTS OF MIRANDO AND COASTAL GAS OILS AT A COKE BURN-OFF RATE OF 12-14 GMS./LITER CATALYST/HR.

Three electrically driven pumps—total capacity 70,560,000 gal per day—here get water for the Wood River, Ill., refinery of Standard Oil Co. (Ind.)

Floating Pump House Maintains Water Supply for 25 Years

A UNIQUE operation has been carried on at the Wood River, Ill., refinery of Standard Oil Co. (Indiana) for nearly 25 years, to supply that plant with huge quantities of water. Many years ago the old Wood River, tributary to the Mississippi a few miles away, was turned from its natural bed and forced to re-enter at a different point higher upstream. This left the old mouth and stream bed only as a backwater, into which water flowed from the main stream. Continuously increasing demands for more plant water finally induced company engineers to hit on the following plan.

A large float 85 ft. long by 25 ft. wide, was built, using eight old, 10-by-30-ft. still shells to provide the required buoyancy. To these shells were bolted I-beams of sufficient strength to support the pumping equipment with any one of the eight shells removed, thus insuring an uninterrupted supply of plant water when necessary to repair or replace the hull. Over this a house shelter was built, and the pumps were placed on a floor dropped a few feet below the level of the outside walk or floor, inside the housing. Around the outside of the float assembly, a wire screen is hung from wooden beam supports, extending 3 ft. or more down into the water. A riding bridge extends from the barge or float to the bank, interconnected with the 36-in. water pipe which carries the water from pumps to the water main leading to the refinery.

Connections

Three pumps are provided, two being each 12,000 g.p.m. capacity, and driven by 2,300-volt, synchronous motors of 600 hp. each, the large pump having 25,000 g.p.m. capacity and driven by an 1,100-hp. motor of the same type. One, two, or all three pumps may be operated simultaneously. Electricity is obtained from the refinery powerhouse.

The pumps are connected by a header or manifold to the 36-in. water main, which extends from the float to the main (fixed) which ends at the bank. This main is connected to the float by four Moran flexible steam joints, which are made up of spherically ground joints which form flexible seals at the float frame and at the end of the fixed water main on the bank. The bridge supporting the 36-in. discharge line and affording access to the pump house is pin connected to bolsters, which in turn, are secured at their centers with pins. This allows free movement of the pump house, both horizontally and vertically. The landward end of this bridge and flexible joints are supported on reinforced concrete piling capped with concrete.

To compensate for the relative change in the position of the bridge floor and the bottom of the 36-in. discharge line caused by the rise and fall of the river, spring-supported rollers riding on plates welded to the bridge floor carry the discharge line. Rise and fall of water in the channel follows the river level, and these arrangements give plenty of flexibility to the float's motion requirements. The flexible joints have a traverse of 22½° each. The pump house is protected from windstorms by lines extending from each corner to the banks. The turntables allow the float to move through arcs of 22½° for each table.

Suction line for each pump's intake extends 6 ft. down into the water. Around each is lowered a hexagonal screen assembly; ¼-in. galvanized steel screen sections are provided in duplicate for each of the six sides, and one may be raised to be cleaned of solid obstructions while the other is in place, serving to prevent objects entering the centrifugal pumps. Under certain conditions, innumerable small fish become caught against the screens and obstruct the water flow seriously. These hexagonal screen assemblies are supported by rollers on horizontal flanges fastened to the periphery of the cylindrical intake lines and may be rotated so as to bring each screen section in turn in reach of the catwalk which passes entirely around the float. For fire protection the switchboard and gear are isolated from the pump room and piped with carbon dioxide equipped with fusible links for automatic operation.

TRENDS in Drilling Equipment and COSTS

by
Ivan S. Salnikov

FIGURE 1
AVERAGE WELL DRILLING COSTS

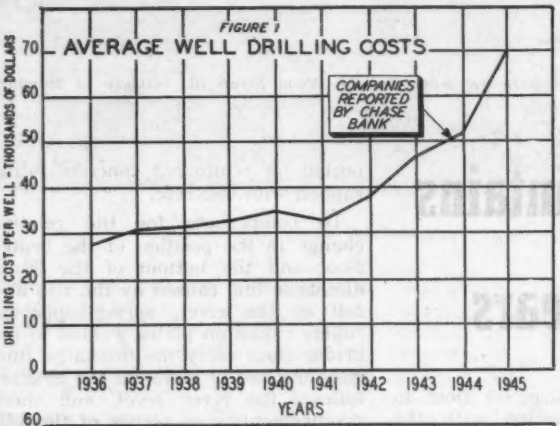


FIGURE 2
TREND IN AVERAGE DRILLING DEPTHS

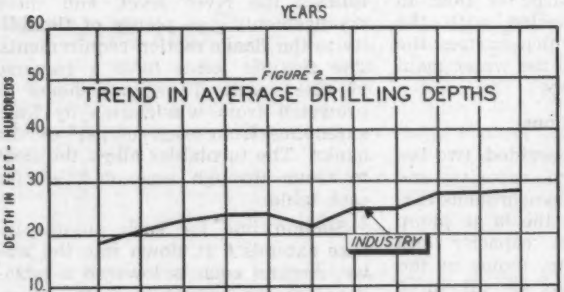
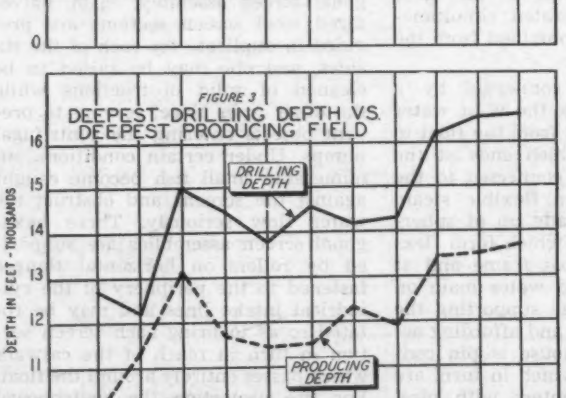


FIGURE 3
DEEPEST DRILLING DEPTH VS. DEEPEST PRODUCING FIELD



THE petroleum industry during the last 10 years drilled some 326 wells below 12,000 ft. in depth, of which 69 were drilled in 1945, and 106 in 1946. This trend toward deep drilling, coupled with rising wage rates and higher equipment costs, has a very significant implication with respect to maintenance of adequate oil supplies at low price.

Ten years ago a 15,000-ft. rig was a matter of curiosity and speculation. Today a 15,000-ft. rig can be had for the asking and the industry's objective is a 20,000-ft. rig. Whether or not crude oil will be found at these depths is a matter for the geologists to settle. Interest in this regard lies primarily in the type of equipment needed to drill such depths and in drilling costs.

Deep drilling also is of interest for the reason that the developments in deep drilling stimulate progress in drilling equipment and techniques and by that exert a pronounced influence on normal drilling costs.

Drilling Rigs and Equipment

The war retarded progress in development of drilling equipment and methods but as peace came and industry was freed from war-made shortages in manpower and materials, the pace of progress has been once more brought to normal. As the result of war and postwar developments better steels, bearings, lubricants, and industrial know-how became available. With these, it will become possible to design and produce improved-type draw works, drill pipe, bits, wire lines, etc.

New rigs equipped with airflex couplings and airbrakes

THE AUTHOR

IVAN S. SALNIKOV

The author is coordinator of engineering and equipment, producing department, Standard Oil Co. (N. J.). He is a graduate of Colorado School of Mines, 1925. From that time until taking up his present duties in New York City in 1944, he was with The Carter Oil Co., successively as petroleum engineer, division engineer, division superintendent, and chief engineer.

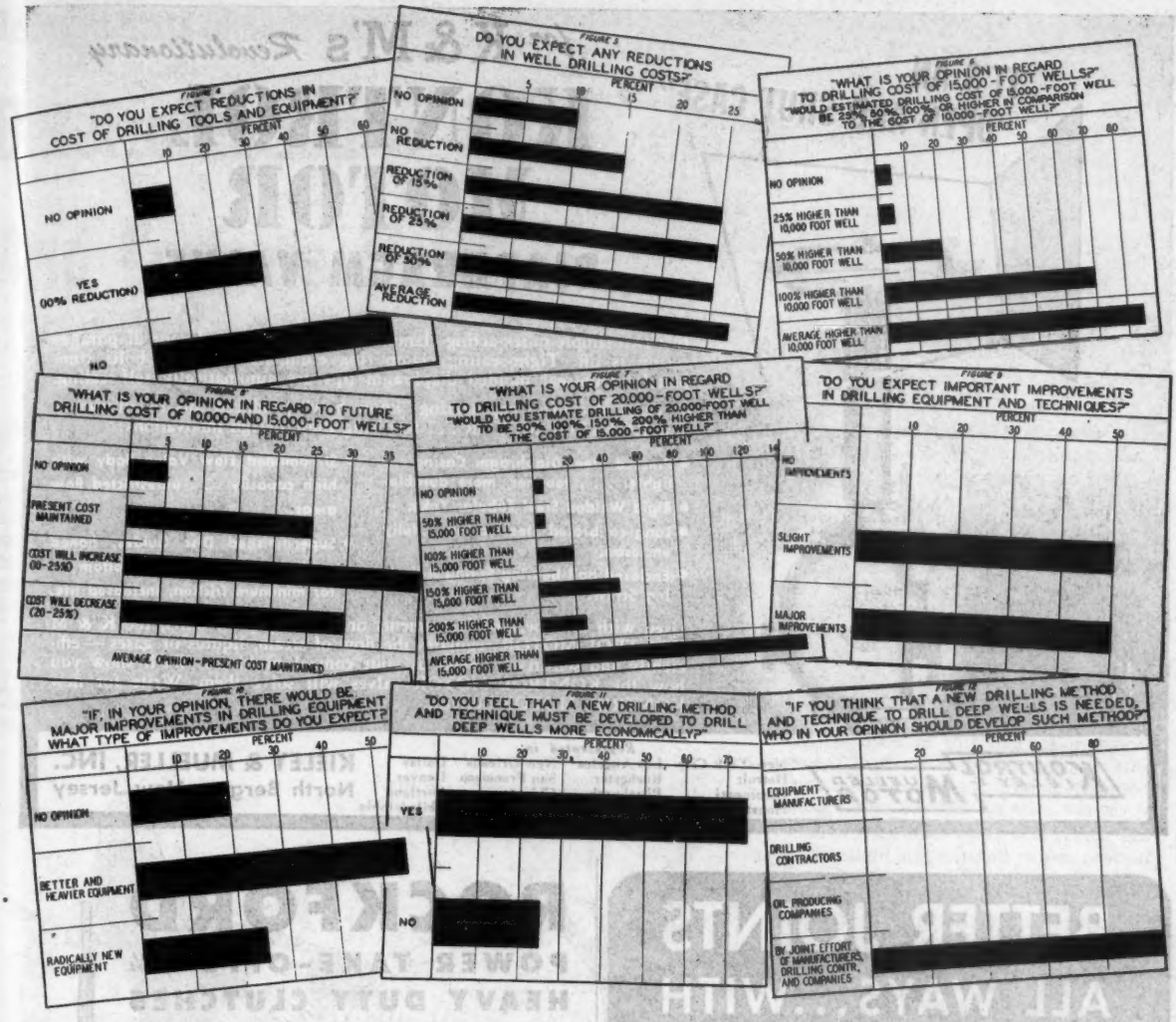


FIGURE 4
"DO YOU EXPECT REDUCTIONS IN COST OF DRILLING TOOLS AND EQUIPMENT?"
PERCENT
NO OPINION
YES 00% REDUCTION
NO
FIGURE 5
DO YOU EXPECT ANY REDUCTIONS IN WELL DRILLING COSTS?"
PERCENT
NO OPINION
NO REDUCTION
REDUCTION OF 15%
REDUCTION OF 25%
REDUCTION OF 50%
AVERAGE REDUCTION
FIGURE 6
"WHAT IS YOUR OPINION IN REGARD TO DRILLING COST OF 15,000-FOOT WELLS?" "WOULD ESTIMATED DRILLING COST OF 15,000-FOOT WELL BE 25%, 50%, 100%, OR HIGHER IN COMPARISON TO THE COST OF 10,000-FOOT WELL?"
PERCENT
NO OPINION
25% HIGHER THAN 10,000 FOOT WELL
50% HIGHER THAN 10,000 FOOT WELL
100% HIGHER THAN 10,000 FOOT WELL
AVERAGE HIGHER THAN 10,000 FOOT WELL
FIGURE 8
"WHAT IS YOUR OPINION IN REGARD TO FUTURE DRILLING COST OF 10,000-AND 15,000-FOOT WELLS?"
PERCENT
NO OPINION
PRESENT COST MAINTAINED
COST WILL INCREASE (0-25%)
COST WILL DECREASE (20-25%)
AVERAGE OPINION-PRESENT COST MAINTAINED
FIGURE 7
"WHAT IS YOUR OPINION IN REGARD TO DRILLING COST OF 20,000-FOOT WELLS?" "WOULD YOU ESTIMATE DRILLING OF 20,000-FOOT WELL TO BE 50% 100% 150% 200% HIGHER THAN THE COST OF 15,000-FOOT WELL?"
PERCENT
NO OPINION
50% HIGHER THAN 15,000 FOOT WELL
100% HIGHER THAN 15,000 FOOT WELL
150% HIGHER THAN 15,000 FOOT WELL
200% HIGHER THAN 15,000 FOOT WELL
AVERAGE HIGHER THAN 15,000 FOOT WELL
FIGURE 9
"DO YOU EXPECT IMPORTANT IMPROVEMENTS IN DRILLING EQUIPMENT AND TECHNIQUES?"
PERCENT
NO IMPROVEMENTS
SLIGHT IMPROVEMENTS
MAJOR IMPROVEMENTS
FIGURE 10
"IF, IN YOUR OPINION, THERE WOULD BE MAJOR IMPROVEMENTS IN DRILLING EQUIPMENT WHAT TYPE OF IMPROVEMENTS DO YOU EXPECT?"
PERCENT
NO OPINION
BETTER AND HEAVIER EQUIPMENT
RADICALLY NEW EQUIPMENT
FIGURE 11
"DO YOU FEEL THAT A NEW DRILLING METHOD AND TECHNIQUE MUST BE DEVELOPED TO DRILL DEEP WELLS MORE ECONOMICALLY?"
PERCENT
YES
NO
FIGURE 12
"IF YOU THINK THAT A NEW DRILLING METHOD AND TECHNIQUE TO DRILL DEEP WELLS IS NEEDED, WHO IN YOUR OPINION SHOULD DEVELOP SUCH METHOD?"
PERCENT
EQUIPMENT MANUFACTURERS
DRILLING CONTRACTORS
OIL PRODUCING COMPANIES
BY JOINT EFFORT OF MANUFACTURERS, DRILLING CONTR. AND COMPANIES

Contractors give views on costs, equipment, methods

are now available for drilling up to 16,000 ft. in depth. Engine manufacturers have made notable progress in gas and diesel-engine designs and these developments go a long way in providing better mechanical power plants that can be counted upon to improve performance and efficiency of drilling rigs.

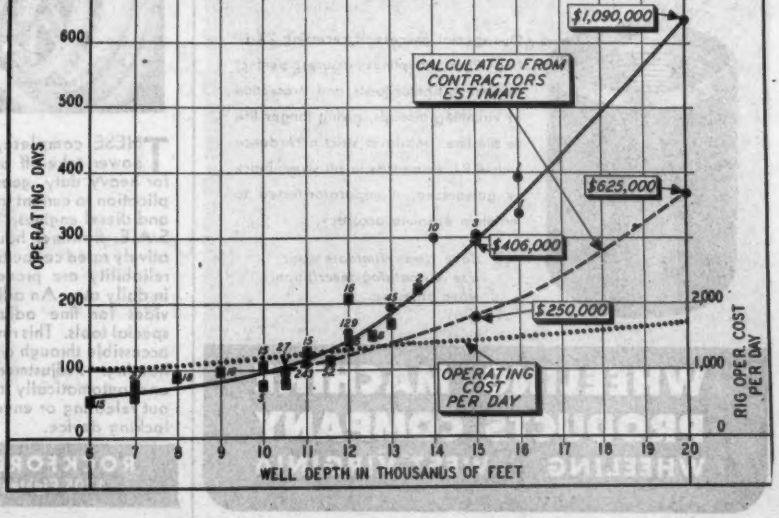
Drilling Practices

In parallel with advances in rotary rigs and equipment aimed at 15,000 ft. and deeper drilling, notable progress in drilling technique and practices has been made. Drilling-mud control has already received universal recognition by all who are engaged in drilling operations. Many drilling contractors now consider mud control as a "must" technique and one of the most important drilling aids. This type of thinking naturally promotes greater progress in mud practice, chemical additives, use of oil-base muds, and improvements

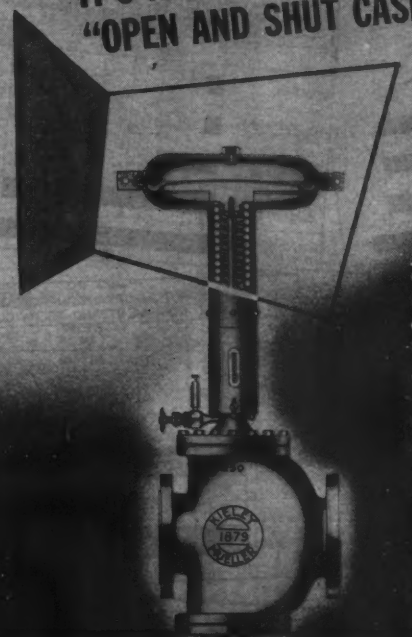
(Continued on page 269)

FIGURE 13

OPERATING DAYS AND OPERATING COST PER RIG PER DAY VS. WELL DEPTH



IT'S AN "OPEN AND SHUT CASE"



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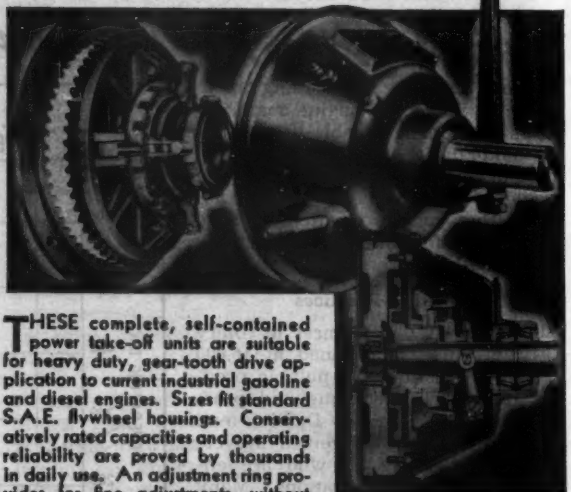

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Restored-State Method for

Determination of Oil in Place And Connate Water

by W. A. Bruce* and H. J. Welge†

FOR the purpose of this discussion connate water will be defined as that interstitial formation water coexisting with oil or gas in a petroleum reservoir at the time the reservoir was first drilled. It is realized that this definition is at variance with the original geological definition of the term connate water. However, common usage has made the above arbitrary definition a part of petroleum technology.

*Head of production research and †research chemist, research division, The Carter Oil Co., Tulsa. Paper presented at the spring meeting of the Mid-Continent district A.P.I. Division of Production, Amarillo, Tex., May 22-23, 1947.

It is now reasonably well established[1,2] that connate water as defined above exists in virtually all natural accumulations of petroleum, although because of flushing by drilling fluid very little of it has been recovered from the cores heretofore. Connate water has been found at the top of several reservoirs having as much as 2,000 ft. of vertical oil column from the water-oil contact to the crest of the structure. One set of cores has been obtained with oil-base mud from Rangely field 600 ft. above the water-oil contact. These cores contained almost 50 per cent formation water when received.

Common usage has made it necessary for laboratories to report connate water as per cent of pore volume. Actually the engineer wants to know the per cent of bulk core volume filled with oil, so that total oil can be directly computed from the acre-feet of oil section. Both quantities will be used in this discussion since, except in cases where porosity is unknown, oil-in-place can be determined from connate water or vice versa.

In argillaceous rock, the grains are so swollen and altered when wetted that the dry porosity may bear little relation to the porosity available for fluid occupancy in the reservoir. In this event, it may be difficult to measure the reservoir porosity at all, and not really necessary provided one expresses the original oil-in-place as a percentage of the bulk volume of the core as suggested above.

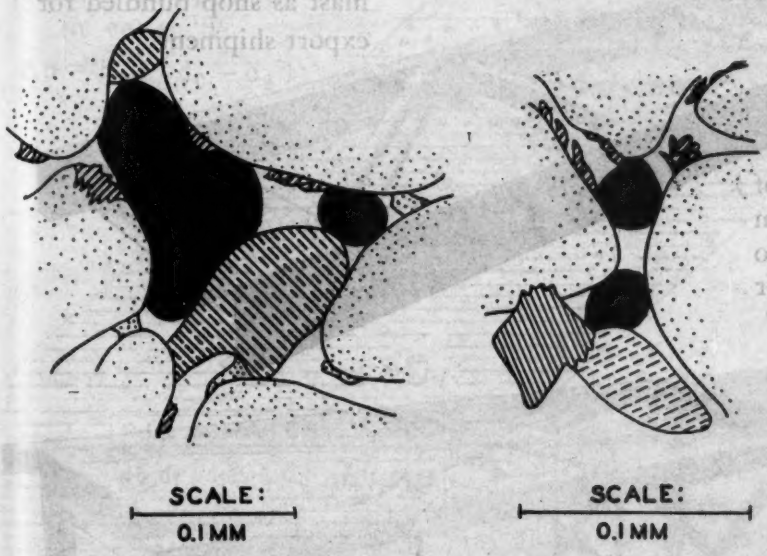

Fig. 1—Qualitative representation of some probable positions of oil and connate water in place

Theory and Laboratory Experiments

Theory[4] indicates that oil and water coexist in porous media in such a way that the percentage of oil and water in any given porous medium depends upon the difference in pressure between the two phases and, possibly, upon which of the two fluids was in place first. This difference in pressure results from molecular forces which cause the curved interface between two fluids coexisting in a capillary, and which can be experimentally measured.

An experimental procedure has been developed in which reservoir cores are first saturated with water and then the water is displaced from the cores of oil. Difference in pressure between the oil and water phases is maintained by placing one face of the core in contact with a water-wetter membrane which will allow passage of water, but prevent escape of oil by reason of the very small diameter of its pores. As the pressure difference between the phases is increased, a pressure is finally reached

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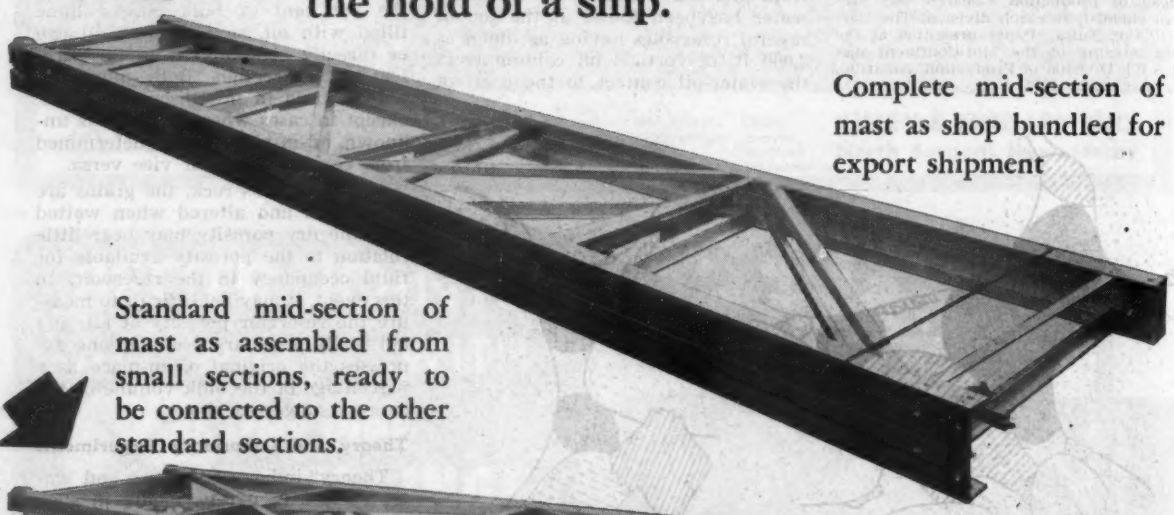
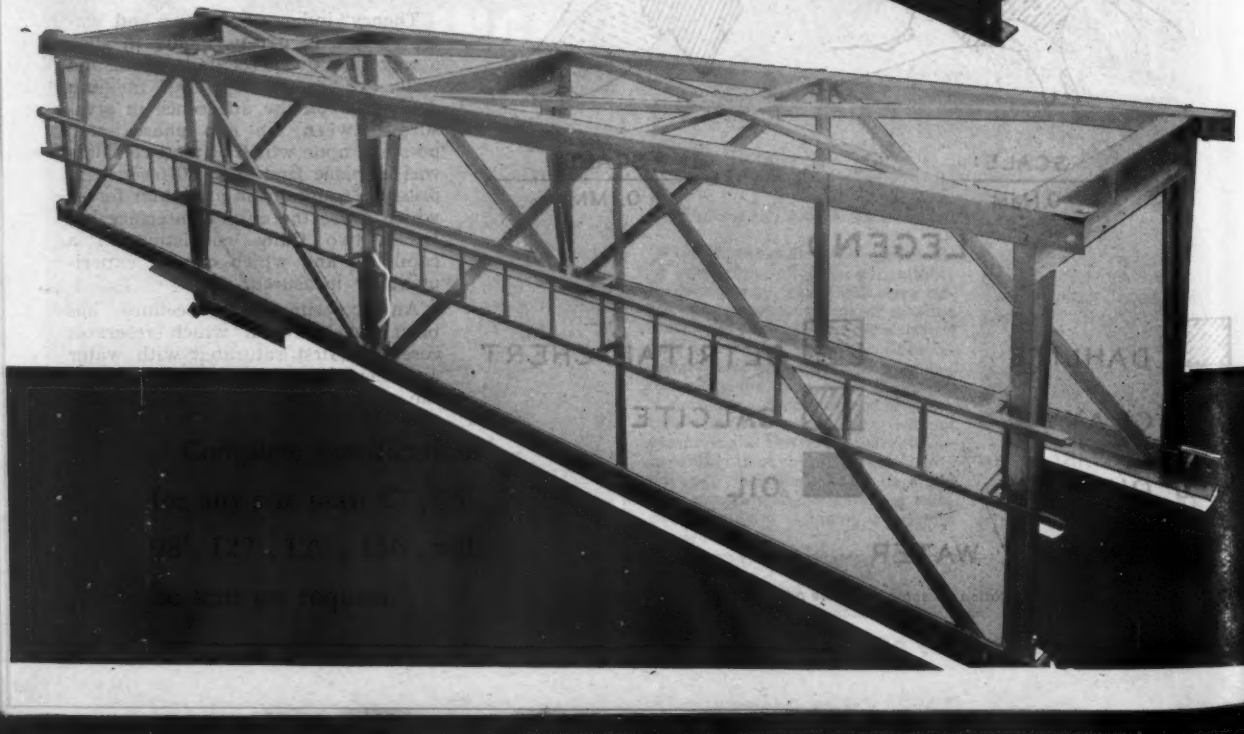


Complete mid-section of mast as shop bundled for export shipment

Standard mid-section of mast as assembled from small sections, ready to be connected to the other standard sections.



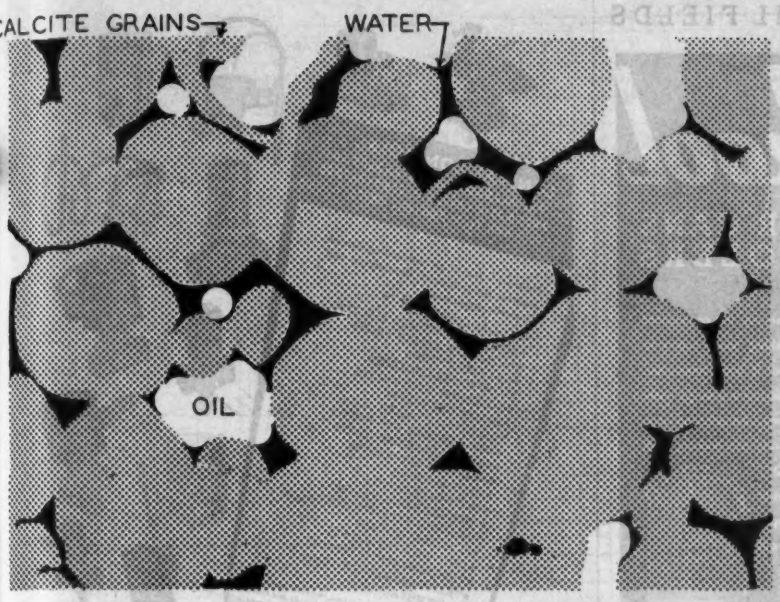


Fig. 2—Another "picture" of oil and connate water in a producing formation

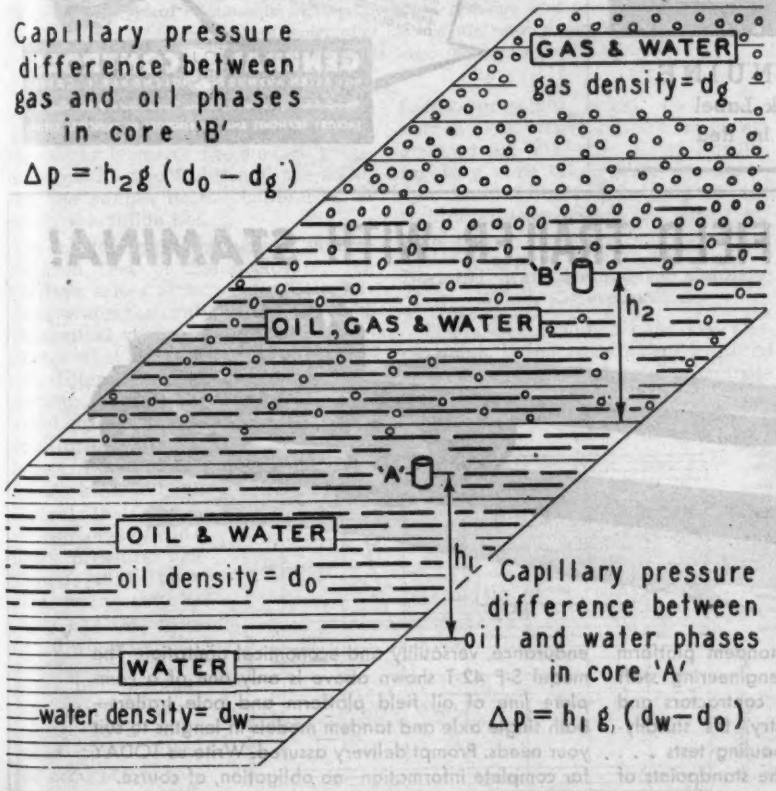

Capillary pressure difference between gas and oil phases in core 'B'
$\Delta p = h_2 g (d_o - d_g)$
GAS & WATER
gas density = d_g
'B'
h_2
OIL, GAS & WATER
'A'
OIL & WATER
oil density = d_o
h_1
Capillary pressure difference between oil and water phases in core 'A'
$\Delta p = h_1 g (d_w - d_o)$
WATER
water density = d_w

Fig. 3—Illustrating how gravity acts on oil and water, establishing a difference in pressure

after which there is no appreciable reduction in water saturation with further increase of pressure on the oil phase. This experiment produces a curve of capillary pressure vs. water saturation which becomes practically vertical at some minimum water saturation. The region of this curve in which the water saturation reaches and remains substantially at a minimum has been termed the minimum water content or the irreducible water saturation.

It is believed that as oil migrates into a water-filled formation, it displaces the water from the formation just as the water was displaced from core fragments in the experiment described above. The displacement pressure is provided by the difference in density between the invading oil and the water originally in place. This displacement pressure, Δp, is given by Equation 1:

$$\Delta p = h_1 g (d_w - d_o) \qquad (1)$$

where h_1 is the height of the core in question above the highest level in the reservoir of zero oil saturation, g is the acceleration of gravity, and d_w and d_o are the densities of the brine and oil phases, respectively.

Figs. 1 and 2 show qualitatively how oil and water probably lie in the porous rock of the petroleum reservoir. Fig. 3 illustrates how gravity acts on these two fluids to establish a difference in pressure between the two phases.

The system can be considered to be in a state of equilibrium when the difference in pressure caused by the difference in density, indicated in Equation 1, equals the capillary pressure between the two phases, Equation 1:

$$\Delta p = \gamma \left(\frac{1}{r_1} + \frac{1}{r_2} \right) \qquad (2)$$

in which γ is the interfacial tension and r_1 and r_2 are the principal radii of curvature between the phases. The same type of equilibrium adjustment exists between the gas and oil phases as indicated by Fig. 3.

Equation 1 is an expression of hydrostatic equilibrium between coexist-

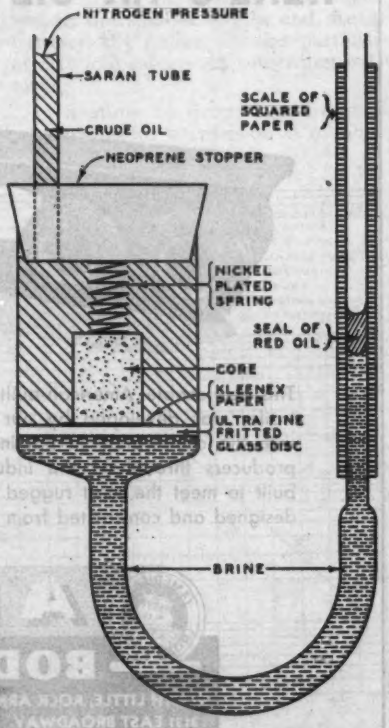


Fig. 4—Cross-section of restored-state core test apparatus

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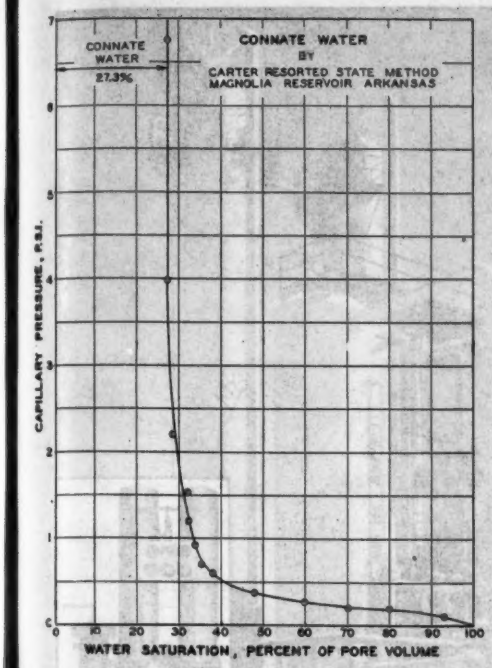


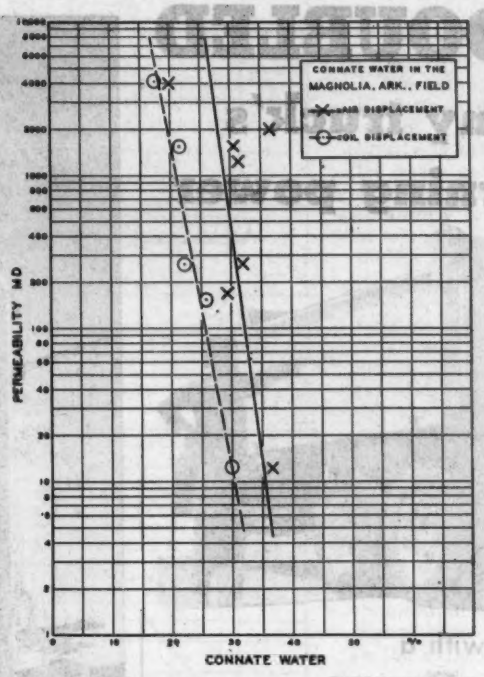


Fig. 5—(Left) Typical relationship between capillary pressure and per cent of pore volume containing water. Fig. 6—(Right) Minimum residual water after oil and air, respectively, have displaced 0.1 N NaCl solution from oolitic limestone cores (Magnolia field, Arkansas)

ing immiscible fluids. Equation 2 is the expression of this pressure difference in terms of the surface properties of the two fluids and the solid, and the shapes of the capillaries in which the fluids lie.

In considering a reservoir of several hundred feet or more closure, the question arises as to whether a minimum water saturation really exists. Theoretical study of the problem indicates that at some capillary pressure difference the residual water saturation should approach zero, provided complete equilibrium is attained. Experimental work on soils at several thousand atmospheres of capillary pressure[6] has shown that near zero water saturation can be produced when the displacing phase is a gas. In practice, laboratory experiments have indicated that, within the accuracy of saturation measurements, a minimum saturation does exist within the range of pressures encountered in reservoirs having less than 1,000 ft. of closure. In the major part of most petroleum reservoirs the water found in place when the reservoir is first tapped should be equivalent to the minimum water remaining in a core taken from the reservoir and restored according to the technique described in the above experiment.

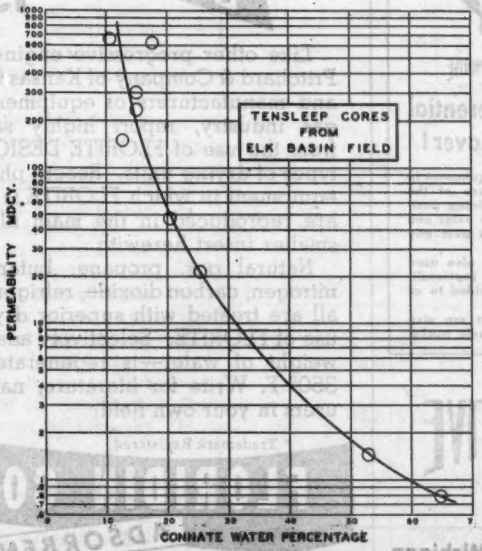
Restored State Method for Connate-Water Determination

The above assumed capillary phenomenon is the basis of the restored state method for determining connate water. In the laboratory experiment, after several pounds difference in pressure has been established between the water and oil phases they assume a distribution in the porous rock such as is indicated by Figs. 1 and 2. The distribution of the water and oil is probably a function of four factors:

1. The interfacial tension between the oil and water.
2. The general size and shape of the capillaries making up the porous medium.
3. The direction of fluid displacement.
4. The texture of the rock forming the capillary wells.

The last factor is probably very complex since the capillaries are themselves lined with finer particles of materials which are different from the grains making up the matrix of the capillary system. Refer to Fig. 1 and it will be noted that the large matrix is made up principally of quartz grains and that these larger quartz grains have, along their edges and in the smaller angles and areas, between the grains, smaller particles of clay and calcareous cementing material.

In a study to determine the connate water for a reservoir a number



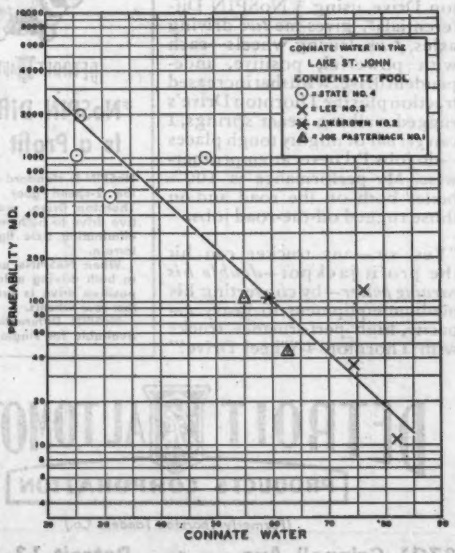


Fig. 7—(Left) Tensleep sand cores (Elk Basin field, Wyoming), displacement of dilute phosphate buffer. Fig. 8—(Right) Irreducible water saturation, Lake St. John cores (Louisiana)

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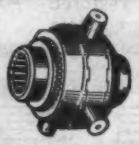

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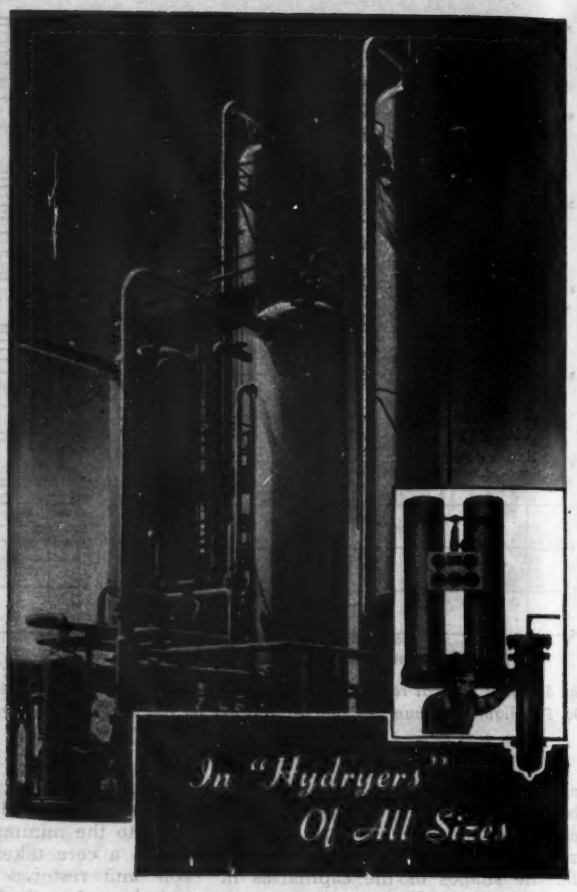

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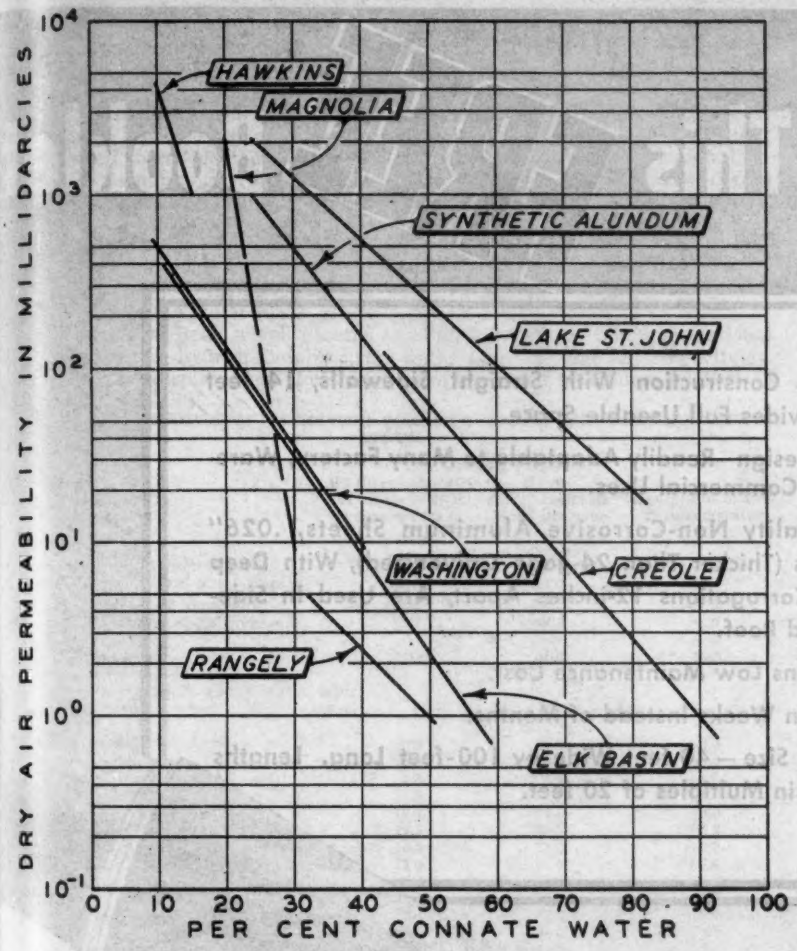

Fig. 9—Connate water vs. permeability

of cores (probably 10 to 20) are chosen to represent a wide selection of the petrographic characteristics likely to be encountered in the reservoir with particular care being taken to assure getting a complete coverage of permeability distribution. Considerable care is also taken in obtaining the cores and preparing them for laboratory tests.

It is thought desirable to minimize exposure of the cores to atmospheric oxygen while they still contain oil because it has been found that oxygen reacts with certain constituents in crude oil to produce grayish or whitish solids[4] which do not dissolve in either oil or water. If once allowed to form in the pores, these solids might remain there as films and modify the character of the subsequent displacement. A satisfactory procedure at the well site is to can the sores in lubricating oil (additive-free type) as soon as they are brought to the surface.

The cores obtained from the field are drilled with a 1-in. diamond core drill, and one face is made flat with a wet carborundum wheel or a metal polish wheel and a carborundum slurry. The core is then cleaned by Soxhlet extraction and saturated with brine from the reservoir or with a synthetic brine solution having similar ionic properties. The porosity of the core is then determined by a weight process.

The core saturated in this manner is set up in an apparatus, as indicated in Fig. 4, in such a way that continuity is established between a water phase below the fritted disk and a water phase inside the core. This continuity is maintained with the aid of soft paper[3] which is placed between the core and the disk. Crude oil from the field which is being studied is poured around the core and a difference in pressure between the oil phase and the water phase is established. The pressures employed are sufficient to cause the oil to enter the pores of the rock specimen, but not those of the semipermeable membrane. This is because the average pore radius of the latter is less than 1 micron, and therefore, the curvature required of an entering oil-water interface (approximately given by the fraction 1/r) is correspondingly large. Consequently, the capillary pressure required to invade the membrane is higher than any pressure employed in the experiment.

As this difference in pressure is increased, water is forced out of the core. A typical resulting relationship between capillary pressure and the per cent of the pore volume containing water is indicated in Fig. 5. With cores containing only a small amount of argillaceous material it has been found that the capillary pressure vs. water saturation curve becomes vertical rather quickly as indicated by connate water apparatus and the residual water measured precisely by distillation with toluene in a manner similar to that described in U. S. Bureau of Mines bulletin R.I. 4004.

It is possible to obtain 'connate water" or any porous and permeable specimen, whether or not it is derived from a zone of a reservoir containing

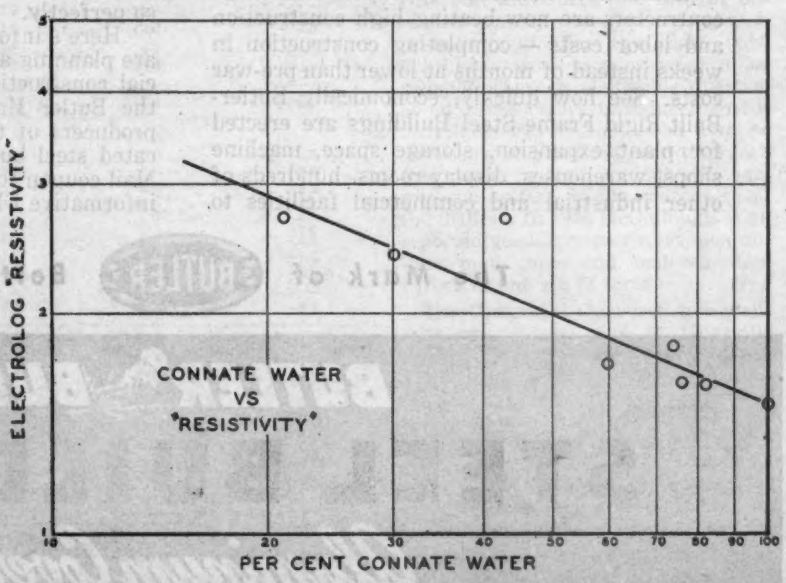

Fig. 10—Restored-state connate water vs. electric log "resistivity" (data for Lake St. John)

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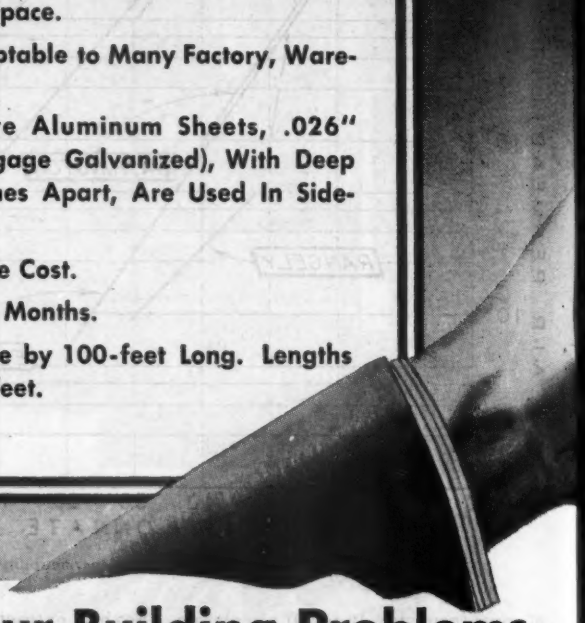

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oil or gas. Thus some additional information about the location of the oil-water contact is always desirable. Ordinarily when routine connate water values are obtained on cores, a sufficiently high displacing pressure is employed to reduce the water saturation to its minimum value. It must be emphasized that the saturation data so obtained is supplementary to, and does not in any way take the place of, knowledge of the type of fluid encountered in the reservoir and the position of the water table. When information is at hand which permits estimation of the hydrostatic pressure available for displacement for any height of a core above the water table (Fig. 3), displacement is allowed to stop when this capillary pressure is reached. Otherwise, it is assumed that the hydrostatic pressure in the reservoir was sufficient to reduce the water saturation to a near minimum. In practice a core more than 50 ft. above the water table in the reservoir will probably contain its minimum water saturation.

Results and Comment

Fig. 6 shows the minimum residual water after oil and air, respectively, have been used to displace 0.1 N NaCl solution from oolitic limestone cores taken from Magnolia field in Arkansas. It should be noted that the difference between the two sets of results, while moderate, is significant. Consequently, It is considered preferred practice to use the crude oil from the field in question when possible. This procedure is recommended in development work until it can be established that the use of another displacing medium, such as a gas or a refined oil, is justified.

Fig. 7 shows the displacement of dilute phosphate buffer, pH = 6, from sandstone cores taken from the Tensleep sand of Elk Basin field in Wyoming. The more permeable Elk Basin sand is highly quartzitic, containing little else besides silicon dioxide. It will be noted that, in general, the connate water increases with decreasing permeability, although the nature of the dependence is different in different areas. No significant influence of porosity, as such, on connate water has manifested itself.

Fig. 8 shows the irreducible water saturation for cores from the Lake St. John pool in Louisiana. Here nitrogen was used as the displacing fluid, in order to simulate the gas phase in the reservoir.

Fig. 9 shows several curves of connate water vs. permeability in relationship to each other. The use of semilog paper for these correlations has no significance other than to compress the permeability scale.

TABLE 1—COMPARISON OF RESERVOIR CONNATE WATER AND RESTORED-STATE TESTS

Type core—	Per cent connate water— By direct analysis of oil-base-mud recovered cores	By indirect restored state analysis	Deviations of the restored state
		(via O)	
Hitesville pool, Russelberg No. 1	34.2	52.4	+18.2
(Waltersberg sand-Mississippian)	33.0	45.0	+12.0
Porosity range 15-20 per cent	24.7	29.2	+4.5
Permeability range 50-300 md.	32.7	40.7	+8.0
Average	*31.2	41.8	*+10.6
*Cores about 25 ft. above water table.			
		(via O)	
	20.9	25.5	+4.6
	20.9	20.3	—0.6
	5.8	7.4	+1.6
	13.8	17.5	+3.7
	12.4	14.4	+2.0
Hawkins pool, E. M. Faulk No. 7	17.3	20.2	+2.9
(Woodbine sand, Gulf Cretaceous)	10.5	13.8	+3.3
	12.6	14.0	+1.4
Porosity range 15-30 per cent	9.5	8.8	—0.7
Permeability range 1-5 darcies	11.0	10.3	—0.7
	7.4	11.3	+3.9
	8.8	14.5	+5.7
	8.5	14.9	+6.4
	9.2	15.8	+6.6
	19.1	16.0	—3.1
	19.2	19.3	+0.1
	18.9	19.2	+0.3
	21.9	20.5	—1.4
Average	13.8	15.8	+2.0
		(via A)	
Hawkins pool, E. M. Faulk No. 7	17.3	19.0	+1.7
(Woodbine sand, Gulf Cretaceous)	12.4	12.0	—0.4
Porosity range 15-30 per cent	13.8	14.4	+0.6
Permeability range 1-5 darcies	20.9	20.0	—0.9
Average	16.1	16.4	+0.3
		(via A)	
	5.4	8.0	+2.6
	5.4	8.0	+2.6
Hawkins pool, S. H. Moore No. 7	5.0	7.2	+2.2
(Woodbine sand, Gulf Cretaceous)	8.1	10.9	+2.8
	8.4	10.4	+2.0
Porosity range 20-30 per cent	8.4	9.7	+1.3
Permeability range 2-5 darcies	4.8	5.8	+1.0
	4.4	7.7	+3.3
Average	6.2	8.5	+2.2
		(via A)	
	46.4	45.2	—1.2
Rangely pool, Hefly No. 1	48.3	44.0	—4.3
(Weber sand, Pennsylvanian)	48.2	46.0	—2.2
	50.6	48.2	—2.4
Porosity range 5-10 per cent	44.9	37.9	—7.0
Permeability range 0.1-5 md.	52.6	51.7	—0.9
	44.3	40.9	—3.4
	50.3	48.9	—1.4
Average	48.2	45.4	—2.8
Composite average	20.8	22.6	+1.8

O = Oil displacement. A = Air displacement.

Use of Oil-Base Mud to Recover Cores With Connate Water in Place

Since, for the most part, the connate water in reservoir rock has been reduced to a near irreducible minimum, it may be reasoned that a core can be obtained with an oil-base drilling fluid without disturbing this connate water. Schilthius[7] reasoned this way and introduced the idea of obtaining connate water by drilling with oil-base mud. For the main part, Schilthius' work is considered to be reliable. There is a possible question about small errors introduced in his technique. For example, the mud he was using was not designed to absorb free water which undoubtedly got into the system during the course of the drilling. In 1944 McCullough et al[8] reported good agreement between oil-base mud cores and restored state values in one set of tests.

The Carter Oil Co. cored two wells with an oil-base mud at Hitesville pool in Kentucky in October and November of 1945. Oil-base mud containing an emulsifying agent was used and also the pressure core barrel[9] was employed to see if any connate water was expelled by dissolved gas. The test made was unusual in that when the core was brought to the surface in the pressure core barrel the oil did not have any measurable gas in solution, although there was full pressure on the core. To a

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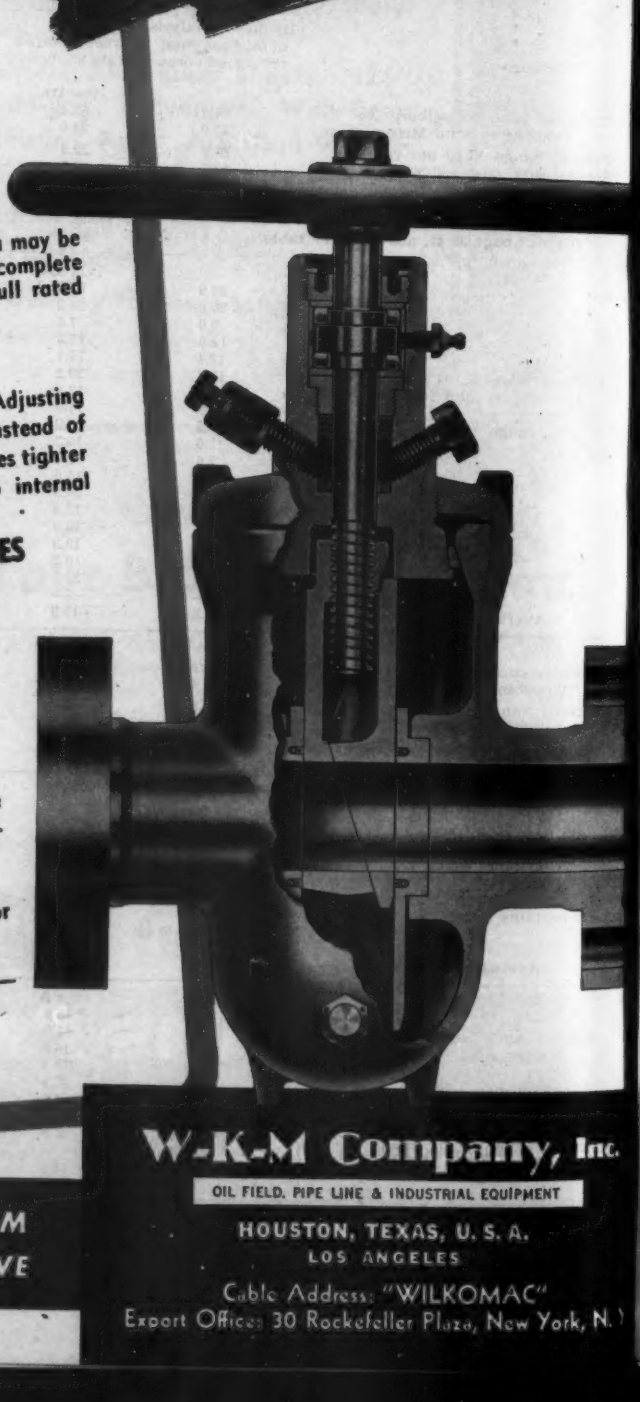

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certain extent the test was inconclusive because the core was obtained about 30 ft. from the water-oil contact and the experimental results indicated that some of the connate water had been expelled by the oil-base drilling fluid during the drilling. The expulsion of this connate water was believed to be promoted by the fatty acids which were used as an emulsifying agent in the test. Nevertheless, the agreement between the restored state tests and the direct measurements of water from the cores was sufficiently close to make it seem desirable to use restored state tests for the determination of connate water. However, the data indicated that connate water determined from cores taken with oil-base mud would be increasingly unreliable as the water-oil contact is approached.

A second series of tests along the above lines was made on cares obtained with a conventional core barrel from two wells in Hawkins field in Texas. The mud used in this and later tests was considered more desirable than fluids previously used for this type of work. It was composed of diesel fuel oil, naphthenic acids, air-blown asphalt, and calcium oxide and hydroxide, blended in such a way that water entering the system would be absorbed to form calcium hydroxide. Table 1 shows the results of tests run on cores taken with oil-base mud. Also shown in this table are the results of preliminary work with oil-base mud on cores obtained with the pressure core barrel in Rangely field.

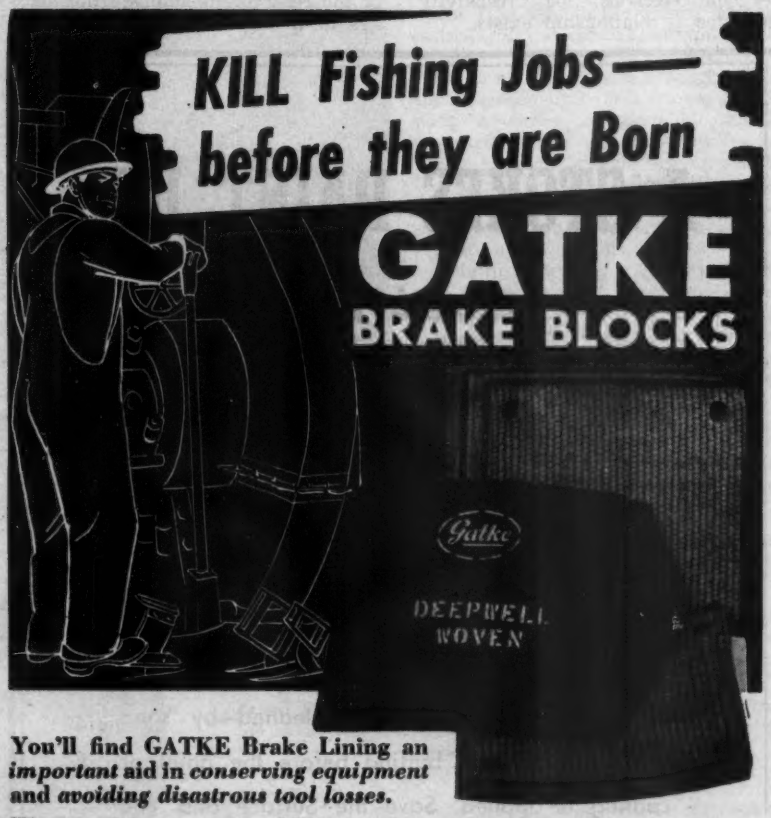
In this test with the pressure core barrel it was found that none of the connate water had been expelled into the barrel by gas coming out of solution. This finding tends to make valid the connate water data obtained with the conventional barrel and oil-base mud provided the cores were obtained sufficiently above the water-oil contact.

Uses of Restored Cores in Laboratory Experiments

The ability to restore oil and water in a fragment of core taken from the reservoir is of considerably more importance than the determination of connate water alone. A fairly sizable experimental program is under way utilizing restored state cores for other tests. In some tests oil is displaced from the restored core by gas, as in a gas drive, and in others oil is displaced by water as in a water drive. Cores are also being prepared by the restored state technique for use in relative permeability tests, and it is planned to prepare cores in this way for gravitational segregation experiments. The restored state technique makes it possible to conduct almost any kind of experiment on the behavior of oil and gas in porous media with the connate water in place as it was in the reservoir. The absence of this connate water in previous experimental work has limited the usefulness of most experiments on the behavior of fluids in sands.

Aid in Interpreting Electric Logs

Another scheme at present being used for the determination of connate water is the method suggested by Archie[9] and now being widely used by Schlumberger. This method involves "calibrating" the resistivity curve in terms of connate water. For this Archie developed formulas which could be used to determine connate water in terms of the logging parameters. There have been few direct tests on the reliability of the Archie method, because in almost every case in which the electric logs have been used for connate-water tests, the cores have been taken with aqueous-base mud, thereby rendering connate-water determinations by conventional core analysis unreliable. The most promising possibility for the use of electric logs for the determination of connate water seems to be a method in which the "calibration" of the resistivity curves in terms of connate water will be made by restored state tests. Direct comparisons would be made between the third



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curve impedance and the restored-state connate water. This should overcome the objection of having to assume the relationship between connate water and resistivity, and relationship between the third curve measurement and specific resistivity. The interpretation of the electric logs will still be subject to all of the difficulties usually encountered in electric log interpretation as a result of varying mud resistivity, mud-water penetration, and lenticularity of the formation.

Fig. 10 illustrates with Lake St. John data how restored-state connate-water data can be used to establish a relationship between connate water and electrical log "resistivity" provided a relationship exists.

One of the most important purposes to which this method of connate-water determination could be directed is the determination of the oil in some definite subdivision of a reservoir or in the reservoir as a whole. The tests outlined above are designed to show how oil lies in a small sample of the reservoir rock; some additional data are necessary to extend the results of a few such tests to an average for the pool as a whole. Figs. 6, 7, 8, and 9 indicate that a fair relationship between permeability and connate water exists for these cases. This phenomenon, if true for every type of lithology, might make it possible to use the average permeability of the reservoir to indicate the average oil-in-place from a connate water vs. permeability curve. This method has proved useful and in most cases has given results with an overall error of about 5 per cent if good permeability-connate water data are available. As it becomes desirable to do more precise work a more sound method for determining pool-wide averages of connate water and oil-in-place from a limited number of tests must be found.

One promising method is a comparison with permeability coupled with a correlation based on rock texture as determined by petrographic means. This method will require much more petrographic study since petrographic factors which affect connate water have not been clearly determined nor has sedimentary petrology advanced to the stage that there is a definite grouping of rock texture properties according to the properties which may, or may not, have an effect upon connate water. At the present time it is known that generally the more clay minerals in a rock the more connate water, but it is also known that the distribution of the clay and the type of clay may be more important than the total clay mineral content.

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Acknowledgment

Rangely and Hawkins cores were obtained through the courtesy of the Stanolind Oil & Gas Co. and Humble Oil & Refining Co., respectively. Dr. P. D. Krynine of Pennsylvania State College, prepared and examined the rock thin sections on which Fig. 1 is based. Valuable assistance in resuring the data reported was rendered by Miss F. A. Jones, W. D. Rose, W. A. Freeman and R. C. West, of the Carter research laboratory. The authors also wish to thank the management of The Carter Oil Co. for permission to publish this paper.

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Coating and Wrapping the 30-Inch California Gas Line

by Paul Reed

THE 30-in. pipe for the new West Texas-California gas line is being fabricated in 60-ft. lengths in the Consolidated Steel Corp. plant in Los Angeles. As it is completed, it is conveyed from the mill over the fence to an adjacent coating and wrapping plant operated by the Bechtel interests.. After coating and wrapping, trucks transport the protected pipe to points along the right-of-way for stringing.

Pipe protection applied in the Bechtel plant consists of one coat of coal-tar enamel and one wrapping of 15-lb. felt paper. The doping plant covers an area of 400,000 sq. ft. and has a skidway for handling pipe in 60-90 ft. sections.

The first step in the doping process consists of the removal of mill scale by shot blasting, using Wheelabrator equipment. The pipe is brought to the shot-blasting unit on a conveyor belt with a series of beveled wheels mounted on the channel-iron frame. These beveled wheels set at angles to the center of the pipe; the angles control the set of feed. The entire assembly is controlled from a central reduction power unit.

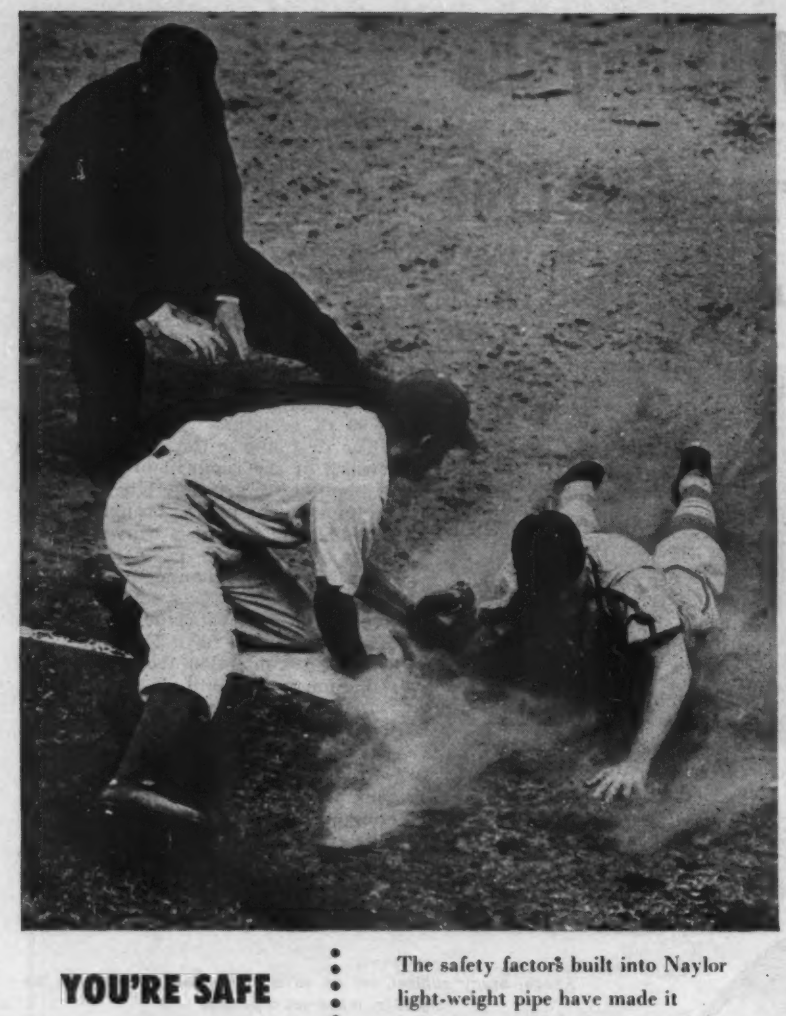
Driving power is transmitted from the reduction unit by a continuous line shaft. At each set of beveled wheels, a special gear box operates the drive wheels. The conveying equipment moves the pipe through the Wheelabrator blasting unit at the rate of 600-900 ft. per hour.

Prior to shot blasting, the pipe is heated by a series of blast jets, set 8 in. apart and 6 in. below the pipe.

Above: Spray cabinet, set up on a production basis, where the big 30-in. tubes get a priming coat

Left: Wrapping machine—the paper feeds in over four sets of rollers; speed and tension are adjusted automatically

Below: Spectacular are the huge stalks of "pipe line" as they are swung onto trucks, and leave for direct transportation to the pipe-line right-of-way



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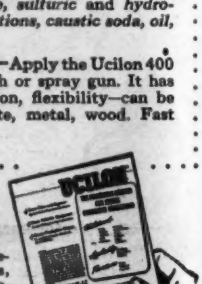

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These jets heat the exterior and remove all moisture before the pipe enters the blaster. (The blaster is an oil type, manufactured by American Foundry & Equipment Co. under the trade name of American Airless Wheelabrator).

Dust separation takes place in canvas dust bags. A dust collector is operated with the customary blower-type fan. As the pipe leaves the blasting furnace, it enters a furnace-type heating unit located 36 in. from the blasting cabinet. In normal operation, this unit is not used since the heat applied to the pipe before it enters the blaster is often sufficient for all operations.

Spray Cabinet

A Prima spray cabinet is equipped with three Model 21 Binks spray guns. This is installed over the conveyor with less than 3-ft. clearance. Spray nozzles are operated in conjunction with 30-gal. pressure priming pots. On the outgoing side a wiping carpet is used to speed the primer and remove surplus material. The primed pipe is ejected from an outgoing conveyor by means of two air-operated evicting units. These evictors are of the piston type and suitable for this service. Tension springs are used to return the lifting arm to the downward position when operating air pressure has been removed. The primed pipe is protected from the sun.

It is essential that the pipe be perfectly level to avoid unnecessary strain on either the ingoing car rolls or the main drive roll. The ingoing car is moved either forward or backward by an air-operated motor.

For supporting pipe, the ingoing car has four sets of hard-rubber-faced wheels set at angles to the center line of the pipe. This set angle is coordinated with the drive roll. The supporting rolls on the ingoing car are equipped with adjustable raising and lowering screws which keep the pipe in perfect alignment with the drive roll.

The drive roll is hooked up with the main-line power unit by a series of bevel gears and chains controlled through a three-speed transmission unit. Installed directly over the drive roll is a strong back arrangement which aids in keeping the pipe in contact with the drive roll. The strong back is of spring-compression type; two sets of rubber wheels are in contact with the pipes that are so installed that they may be adjusted at the same angle as that of a drive roll.

A coal-tar enamel system is used which is of the circulating type, employing a diesel pumping unit. Recycling is controlled by a valve in the reservoir which may be shut off at spreading nozzle without throwing the full pressure load on the pressure feed pumps. When the quick-opening valve is closed at the spreading nozzle, the enamel flows back into the reservoir tank. Pumping units for the coal-tar enamel, of the squeezer type, are manufactured by Granco Pump Co..

Natural-Gas Fuel

The enamel is heated in six tar kettles by means of natural gas. These tar kettles hold 500 gal.—approximately 7,000 lb. of enamel. A total of eight tar kettles of enamel is required for coating 8,000 ft.

The paper holder at the wrapping machine has an inside frame pivoted on a central pin so that any change in the speed of the paper or the roundness of the material causes an automatic adjustment in the paper holder. The paper is fed over four sets of rollers. Tension is supplied by the No. 3 roller or an eccentric arm through which pressure is applied by a small air ram. It is possible to change from one roller to another without shutting down the main drive.

To keep the primed and wrapped pipe in continuous motion through the wrapping machine, it is necessary to use a set of section couplings. As the pipe leaves the wrapping machine, the free end is supported on an outgoing car equipped with three sets of steel rollers. As the coupled end of the pipe clears the wrapping machine, a second car equipped with a small air lift frees the completed section

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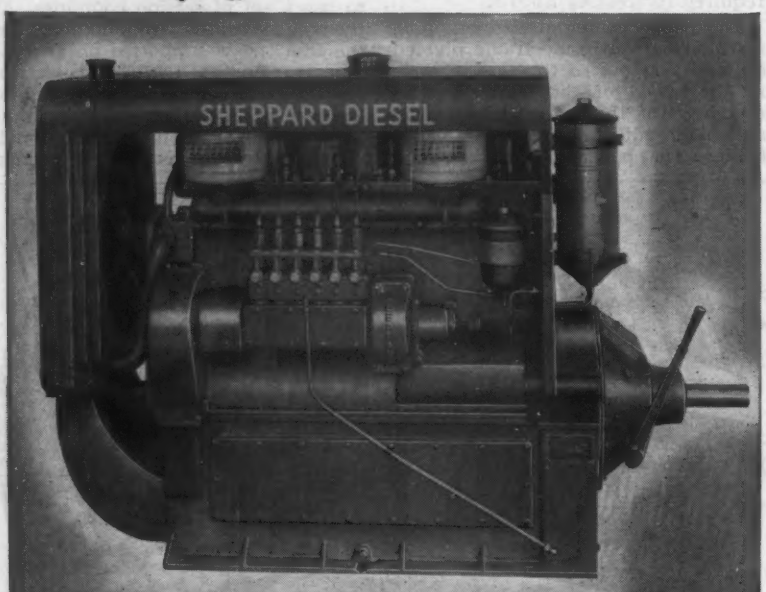

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*Using 8½c gal. fuel oil.

and the two cars carry the section to the end of the outgoing track.

When the wrapped section is lifted clear by jib cranes, the two cars return to the wrapping machine to handle the next outcoming section of pipe. The finished pipe is inspected with a holiday detector; patching is done where needed.

Use of Bead Catalyst

(Continued from page 216)

the yield of 10-lb. R.v.p., 356° F. at 90 per cent motor gasoline exceeded 50 per cent volume of the case charge during the early weeks of operation and decreased gradually to slightly under 40 per cent over the 12 months of on-stream time. Butane and dry-gas yields dropped correspondingly, while the yield of total cycle stock increased from about 36 to 51 per cent volume of the case charge. The average gasoline yield over this 12-month period of operation on bead catalyst is several per cent higher than that observed on Houdry synthetic catalyst during a prior run under comparable conditions in the same plant.

Product-quality change with catalyst age was insignificant except for a slight increase in octane rating of the motor gasoline due to the gradual raising of the cracking temperature. The average octane ratings of the 10-lb. R.v.p., 356° F. at 90 per cent motor gasoline produced over the entire period were 82 C.F.R.-M. and 92 C.F.R.-R. unleaded, and 89 C.F.R.-M. and 98.5 C.F.R.-R. with 3 cc. TEL. Properties of the motor gasoline are shown in Table 2. In general they are similar to those obtained when cracking over Houdry synthetic catalyst.

Regeneration Characteristics

A study of the regeneration pattern during this plant run on bead catalyst showed lower peak temperatures and more gradual rise of the catalyst temperature above that of the cooling salt than was experienced previously with Houdry synthetic cat-

TABLE 1—PHYSICAL PROPERTIES OF NAPHTHENIC OIL* CHARGED TO PAULSBORO HOUDRY UNIT DURING SURVEY PERIODS

Gravity, °A.P.I.	26.7
Aniline No., °F.	132
Sulfur, per cent weight	0.11
Distillation, A.S.T.M., °F.—	
I.B.P.	409
5 per cent volume	463
10 per cent volume	475
20 per cent volume	489
30 per cent volume	504
40 per cent volume	518
50 per cent volume	536
60 per cent volume	556
70 per cent volume	580
80 per cent volume	612
90 per cent volume	670
e.p.	730

*Approximately 50 per cent Mirando—50 per cent Coastal.

TABLE 2—PROPERTIES OF MOTOR GASOLINE FROM CRACKING NAPHTHENIC GAS OIL OVER BEADS IN PAULSBORO HOUDRY UNIT

Gravity, °A.P.I.	54.2
R.v.p., psi.	10.1
Acid heat, °F.	25
Copper dish gum, Mg./100 cc.	<1
Glass dish gum, Mg./100 cc.	<1
Distillation, A.S.T.M., °F.—	
I.B.P.	85
5 per cent volume	105
10 per cent volume	118
20 per cent volume	145
30 per cent volume	176
40 per cent volume	212
50 per cent volume	247
60 per cent volume	278
70 per cent volume	304
80 per cent volume	328
90 per cent volume	358
e.p.	388
Per cent Rec., per cent volume	98.0
Per cent loss, per cent volume	1.2
Per cent Res., per cent volume	0.8
Octane numbers—	
C.F.R.-M. Clear	81.9
1 cc. TEL	81.9
3 cc. TEL	89.8
C.F.R.-R. Clear	92.5
1 cc. TEL	96.4
3 cc. TEL	98.6

alyst. It was concluded therefore that beads could be operated at higher cracking temperatures without exceeding safe regeneration temperature limits, permitting further improvement in yield and octane rating of the gasoline above that actually obtained. The lower temperature rise would also permit operation of the unit at higher coke-burnoff rates provided adequate regeneration air supply and salt cooling capacity are available. This is of particular advantage during periods when some of the cases may be off stream for repairs or catalyst change, since it permits maintenance of a relatively high conversion level without decrease in charge rate.

A further advantage of the lower peak temperatures inherent in bead-catalyst operation is the improvement in life of case liners and tubes. These parts of the Houdry case system may require frequent repair when operating with Houdry synthetic catalyst due to localized high temperatures which develop in the system. With bead catalyst, these "hot spots" are virtually nonexistent.

Economic Considerations

As already indicated, one of the important advantages of bead catalyst over Houdry synthetic catalyst is the lower cost of the former, namely, 12 cents per pound compared to 20 cents per pound for the latter. This means a saving of about $13,000 for a complete catalyst change in a six-case Houdry unit.

Catalyst cost is, however, only one of several factors which enter into the economic appraisal of catalyst for Houdry cracking service. Others include the labor cost and loss of production involved in carrying out the catalyst change. The extent to which these factors could be improved through the substitution of beads for Houdry synthetic has already been discussed. Translating these improvements into economic terms, it is estimated that the use of beads will increase the refinery profit by about $40,000 per year on a standard 10,000-bbl.-per-day Houdry unit. This does not include any credit for increased gasoline yield or possible reduction in maintenance costs due to the use of beads, both of which may be appreciable, based on Paulsboro experience.

In conclusion, the outstanding performance record in the first year of commercial test in Houdry units has established Socony-Vacuum bead catalyst as an efficient, economical catalyst with superior mechanical strength and excellent stability characteristics for fixed-bed as well as T.C.C. cracking.

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PLASTIC *Insulation*

Provides Protection Against Stray-Current Corrosion in Wells and Piping Systems — Oil and Gas Wells

*by J. A. Clay, Jr.**

THE introduction of stray electric currents into a well may cause severe corrosion damage to subsurface equipment, and in certain instances may aggravate previously existing corrosive conditions with the result that corrosion damage is increased in severity and extent. The term "stray currents" is used to designate those electric currents traveling into or away from an oil well via surface media such as flow lines, casing-head gas lines, fuel lines, gas-lift connections, pull-rod lines, and polished rods. In addition to this type of current other currents may exist within the well itself, and never reach the surface equipment where they could be accurately measured; however, this paper is limited to those currents existing at and in the surface equipment.

A fundamental law of electricity is that a current cannot flow, regardless of the available voltage, unless there is a complete circuit. If a complete circuit exists, the amount of current that will flow is directly proportional to the voltage and inversely proportional to the resistance of the circuit, and may be expressed by the equation:

$$I \text{ (current in amperes)} = \frac{E \text{ (voltage in volts)}}{R \text{ (resistance in ohms)}}$$

The resistance of a circuit depends upon the material and cross-sectional area of the current-carrying medium. Salt water is a good conductor of electricity and so is steel. Moist soil, with its mineral salts, and steel pipe lines would therefore have a low resistance and serve as media through which current could easily flow. Due to the almost innumerable circuits that could exist in casing, tubing, rods, and subsurface equipment it is often impossible to determine the exact path a current might take to complete a circuit, but the fact that complete circuits do exist is substantiated by actual measurement of the magnitude of currents in surface equipment.

Spot-Check Value Doubtful

Voltage and current measurements may be made with appropriate instruments, but the value of "spot check" data is doubtful. Tests must be made frequently and over a long period of time if accurate data are to be obtained. As an example, four wells on a lease in West Texas were checked once every 2 or 3 weeks for 5 months, and on all occasions were found to be electrically dead.

During the sixth month one of the

*Service Engineers, Inc., Fort Worth.

Fig. 1—(Extreme left) Part of a West Texas tubing string pitted in one month by electrolytic currents. Fig. 2—(Left) Pipe ruined by improper grounding of an electric motor

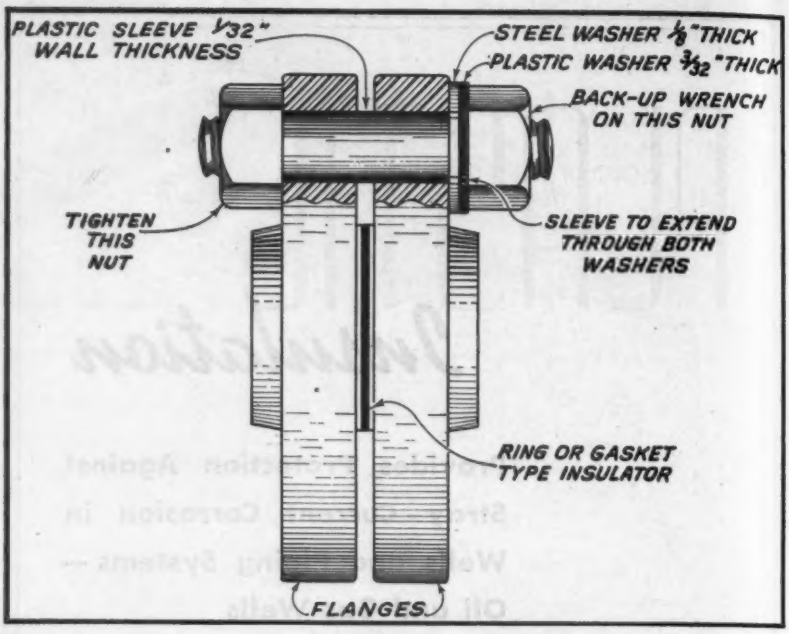
wells was pulled because of a hole in the tubing. Inspection of the pit pattern indicated that the damage had been due to electrolytic currents (see Fig. 1), and the wells were immediately checked again. These tests revealed that on that particular day approximately 0.5 amp. was entering each well via the flow line. The wells were immediately insulated by means of a plastic pipe nipple placed in each flow line near the well head, and such damage was stopped. Experience has shown that the magnitude of currents in surface equipment will vary greatly from well to well on the same lease, from day to day on the same piece of equipment, and even during any given day. In view of this fact, it has been the practice of several major companies to designate "hot spots" or danger acreas according to fields, rather than test each individual well, and to insulate all wells in the field.

The source of currents in surface equipment is often difficult or impossible to find. One type of current has been named "long line," and long-line currents are those generated by galvanic action between a pipe line and the soil in which it is buried or on which it lays. This theory is supported by the fact that flow lines that pass through or near an old mud pit, burn pit, sump, or natural low place where moisture is likely to collect will usually show a larger current than those not passing such points. High-voltage power transmission lines are believed to be capable of inducing a current in a pipe line passing under it or near it, the fluids in the pipe rectifying the current to the direct type.

Electric-Motor Power

Another source of current has been found where a well is powered by an electric motor. An electric drive will not cause trouble when adequately grounded; however, there is one instance known to the writer where the electrician grounded the electrical equipment on the casing head! The ground was electrically perfect so far as the electric equipment was concerned, and it was also a perfect medium through which to introduce current into the well. Fig. 2 shows the result of the above grounding method. Note that the damage is confined to a straight line, and that the remainder of the pipe is in good condition.

Remembering the previous statement that a complete circuit is necessary for current to flow, it is thought that by breaking as many probable circuits as possible corrosion damage from electrolytic currents can be economically reduced, or eliminated. At present several thousand wells have been insulated against stray currents with the result that damage due to such currents has been greatly reduced in all instances,


PLASTIC SLEEVE 1/32" WALL THICKNESS
STEEL WASHER 1/8" THICK
PLASTIC WASHER 3/32" THICK
BACK-UP WRENCH ON THIS NUT
TIGHTEN THIS NUT
SLEEVE TO EXTEND THROUGH BOTH WASHERS
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FLANGES

Fig. 3—Assembly makeup of an insulating flange

and in many cases completely eliminated. In order to obtain satisfactory results it is necessary to completely insulate the equipment; in other words, insulating a flow line may not be enough. There are cases where it has been necessary to insulate flow lines, polished rods, all pipe lines connected to a well, pull-rod lines, water lines, gas-gathering or transmission lines, fuel lines, pipe-line connections at tank batteries, various parts of tank batteries, and tank-battery manifolds in order to eliminate corrosion damage due to stray currents.

The present method of breaking circuits, or insulating equipment, the method most generally accepted, is through the use of laminated plastic materials. These materials are made either in the form of common pipe fittings or as accessories for existing fittings. For pipe lines operating at pressures of 1,000 psi. or less, plastic pipe nipples or bushings are recommended. These plastic fittings may be made according to any standard pipe or fitting specifications, and have a factor of safety varying from 3½ to 5, depending upon the working pressure and size.

Pipe nipples are made in two pressure ranges, namely, 500 and 1,000 psi. working pressures. The physical properties of the nipples are given in Table 1, and show that the material is tough and can take general

Fig. 4—Hooking an ammeter across fitting to check current flow

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oil-field abuse. Any length pipe nipple may be obtained, but the standard lengths are usually 4 and 6 in. Plastic materials are not expensive, but they have a definite application and cannot be used indiscriminately if they are to be used economically. For example, a well requiring two 2-by-4-in. nipples can be insulated at a material cost of less than $5.

TABLE 1—PLASTIC PIPE NIPPLES—PHYSICAL DATA

Size (in.)	O.D. (in.)	I.D. (in.)	Wall thickness (in.)	Threads per inch	Tensile* strength (lb.)
Standard, 500-Psi. Working Pressure					
2	2.375	1.875	0.250	11½	7,500
2½	2.875	2.250	0.313	8	10,400
3	3.500	2.875	0.313	8	12,600
4	4.500	3.750	0.375	8	19,200
1,000-Psi. Working Pressure					
2	2.375	1.625	0.375	11½	9,600
2½	2.875	2.000	0.438	8	14,700
3	3.500	2.500	0.500	8	18,800
4	4.500	3.375	0.562	8	27,800

*Tensile strength as shown is the straight-pull load the nipple can withstand without rupture or shearing of threads, no internal pressure.

Plastic materials should be handled in a manner similar to copper or brass fittings. Extreme tightness in a joint is not necessary to effect a pressure seal, and if a joint is made too tight there is a possibility that the material will be ruptured or so damaged that failure will soon follow. Threaded materials have a tensile strength of over 4,000 psi. of cross-sectional area while nonthreaded, or whole, material has a tensile strength of 10,000 psi. Without internal pressure, the 2 and 2½-in. 1,000-psi. working-pressure nipples will resist straight-pull tensile loads of 9,500 and 14,700 lb. respectively without shearing of the threads or failure of the body. The material is limited to straight-pull loads and will **not withstand eccentric loading.** For this reason it is recommended that nipples be installed either in rigid connections, a swing, or some similar device, whereby either no load exists or the load is applied along the longitudinal axis of the fitting.

When nipples are installed, a steel fitting should be screwed on each end and the unit as a whole tightened by applying wrenches to the steel fitting only. **Do not put wrenches on plastic materials!** When a plastic nipple has been made up sufficiently, it will usually chatter or squeak; do not continue to tighten after the chatter is heard, and do not try to make up the nipple until all threads are in the coupling. Although plastics are tough, threads can be stripped if too much man is on the end of a 36-in. wrench. A 2-in. nipple can be tightened sufficiently by hand to hold 500-psi. pressure. The point should be emphasized that when handled and installed properly plastic pipe fittings will serve their intended purpose well,

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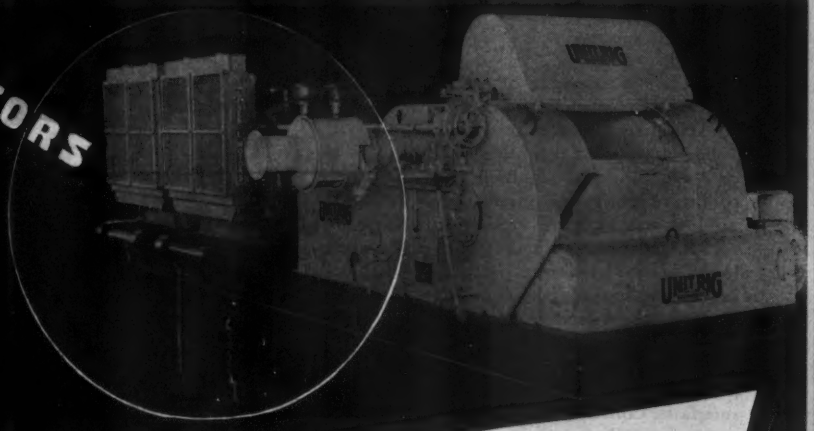

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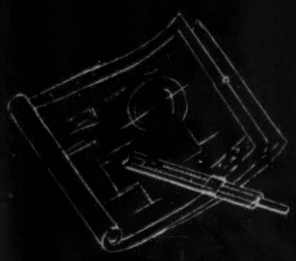

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but if incorrectly applied they will be a constant source of trouble.

Piping Systems

When equipment is operating at pressures exceeding 1,000 psi., or the equipment is of such large size that nipples cannot be used, it is necessary to utilize an insulated flange. One of the largest users of insulated flanges is the pipe-line industry, where such flanges are used to control flows of galvanic, external, or cathodic-protection induced currents. According to Mudd* pump stations should always be insulated from main pipe lines to prevent damage to buried station piping or structures which may be anodic to the main line. A sketch of an insulated flange is shown in Fig. 3. Insulating materials are made to fit any standard A.S.A. or A.P.I. flange, and may be purchased separately for existing flange installations.

*O. C. Mudd, "Control of Pipe-Line Corrosion—A Manual, Part 2," Corrosion, March 1946, p. 43.

TABLE 2—MATERIAL LIST—PER FLANGE UNION

Item—	No. required	Description
Bolt sleeves, plastic.	Same as number of bolts	I.d. = bolt size, wall thickness 1/32 in. Length = 2 × (flange thickness + raised face)
Washers, plastic	Same as number of bolts	I.d. = bolt size + 1/16 in., ⅛ in. thick. O.d. = 2 × bolt diameter
Washers, steel	Same as number of bolts	Same as plastic washers.
Flange gaskets, flat	One per flange union	Thickness ⅛ in. I.d. = i.d. of flange. O.d. = o.d. of raised face of flange
Flange gaskets, ring	One per flange union	Designate by r. number of groove

Note: Washers are designed to fit over plastic bolt sleeve, snug fit. Sleeves should extend through both washers.

When ordering insulating material the following information should be given:

1. Size of flange.
2. Pressure rating.
3. Type of flange.
4. Ring size if a ring-joint flange.

Example 1.—Insulating material for 10-in., A.S.A.-600, general use, raised face flange.

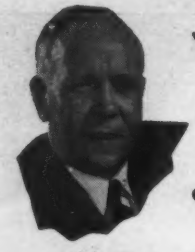
Example 2.—Insulating material for 2-in., A.P.I. Series 1500, oil-field use, raised face, R24 ring groove flange.

Example 3.—Insulating material for 4-in., 125-psi. working-pressure general use, flat faced, 8-bolt (⅝-in. D.) flange.

Table 2 may be used as a guide when ordering flange insulating accessories in quantity lots:

When a pipe line is to be insulated, precaution should be taken to prevent bypassing of the insulating fitting through adjacent soils. The best method is to raise the line above the ground at the location of the fitting, and for 30 to 50 pipe diameters on both sides of the fitting. This practice is not always practical nor feasible and the line must be either buried or rest on top of the ground. In such cases it is recommended that the fitting and from 30 to 50 pipe diameters of pipe on both sides of the fitting be coated, or wrapped and coated, with some waterproof material with good dielectric properties. Pipe-line felt, glass cloth, asbestos cloth, coal-tar enamels, and plastic materials such as Amercoat No. 33 have all been found suitable. Materials must be selected that have good dielectric strength, are waterproof, and that will not react with the fluids carried in the line nor the mineral salts or acids in the adjacent soils.

Insulating material for flanges is not expensive in view of the benefits to be obtained. For example, the insulating material for a 6-in., ASA-600, general use, raised face, R45 ring-joint flange would cost approximately $9



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MAGNETO IGNITION APPLICATIONS. SOUNDS AN ALARM ONLY . . . GROUNDS SINGLE OR DUAL MAGNETO . . . GROUNDS MAGNETO AND SOUNDS AN ALARM OR LIGHTS A SIGNAL LIGHT.

DUAL IGNITION APPLICATIONS. OPENS BATTERY CIRCUIT AND GROUNDS MAGNETO.

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to $13.50 while similar material for a 20-in. R73 flange would cost approximately $31 to $45. The spread in the prices given is due to various quantity discounts that may be obtained.

After a line has been insulated, it is well to check the insulation from time to time to be sure that it is in perfect condition. The amount of current that an insulated fitting is stopping may be determined by hooking an ammeter across the fitting (see Fig. 4). The plastic nipple is between the coupling and the check valve. To test the efficiency of the fitting the current passing by it may be measured by breaking the line behind the fitting and measuring the current with an ammeter, or by checking the voltage drop between two points on the line with a millivolt meter. The current can then be calculated by the previously given equation:

$$\text{current} = \frac{\text{voltage drop}}{\text{resistance}}$$

When making electrical measurements it is important to have clean contact points on the pipe. The contact points should be wire brushed, then a small spot cleaned of rust, mill scale, etc. by filing. This procedure will assist in obtaining accurate measurements.

Conclusion

The contention that electric insulating materials as applied to the petroleum and pipe-line industries are beneficial has been adequately proved by thousands of applications, but due to the numerous factors that must be included in a dollars and cents evaluation such a cost analysis is impossible to make. Some of the factors that must be considered when evaluating any anti-corrosion program may be listed as follows:

1. Loss of life through failure of high-pressure equipment.
2. Actual cost of material replaced.
3. Labor, machinery, and other maintenance costs to repair or replace material.
4. Actual loss of products, oil, gas, water, etc., through failure of equipment.
5. Loss of production time.
6. Loss of probable profit through loss of material, shutdown time, etc.
7. Damage to other property through failure of certain equipment.
8. Lawsuits or claims from others affected by contamination and/or damage to property or product through failure of equipment.

In view of the above, and the low cost of insulating materials, insulation should be considered cheap insurance, and no trouble should be experienced in justifying its use throughout a company on pipe lines, tank batteries, station piping systems, water meters, gas meters, and any other equipment subject to stray currents.

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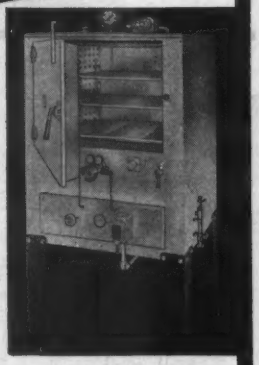

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QUESTIONS on TECHNOLOGY

by W. L. Nelson

Consulting Engineer

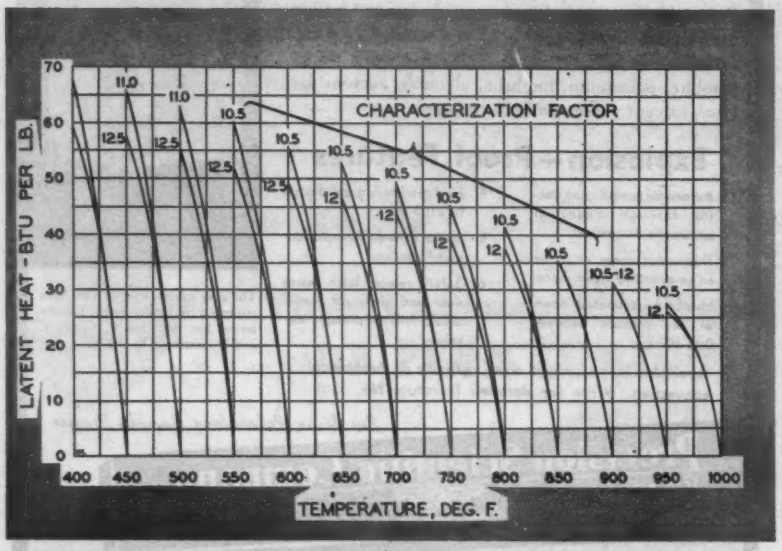

Fig. 1—Latent heat of petroleum fractions near the critical point

Latent Heat Near Critical Point

In using your Refiner's Notebook of May 26, 1945, on Heat of Vaporization we cannot check with other data available.—L. R. S.

Difficulty has already been encountered in the use of the latest heats from Refiner's Notebook No. 43, but the trouble lies in the fact that latent heats near the critical point cannot be computed accurately by available methods. The values in Notebook No. 43 have been checked against the Shell Oil Co., Inc., chart (Petroleum Refiner, April 1945) and on against Watson (Ind. Eng. Chem. 23, 360, 1931) from which the charts were originally prepared.

A better method of comparing materials for the purpose of obtaining latent heats (at high temperatures) is the critical temperature. Accordingly, Fig. 1 on this page indicates latent heats based on uniform increments of critical temperature and for stocks ranging from cracked (or naphthenic) to highly paraffinic ones.

More on Coking of Tubes

Comment: W. F. R. expresses surprise that this department was not informed of the use of thermocouples on the outside of cracking-still tubes for timing their shutdowns. The "Coking of Tubes" was discussed on page 130 of the April 19, 1947, issue of The Oil and Gas Journal on the Questions on Technology page.

It appears that a large refiner used this method of controlling operations earlier than 1936. Shutdowns were caused by one of three situations or warnings: (1) mechanical failure, (2) coking of soaking drum, or (3) excessive tube-metal temperature. The thermocouple temperature proved to be proportional to thickness of coke deposits except when flame impingement occurred.

Flash Points by Different Instruments

A few states still use the Foster tester for the flash point of kerosine. What is the relation between the Foster flash point and the Tag flash point?—F. C. E.

There can be no exact relationship between the flash points obtained by different instruments. If the flash point is caused by a small "tail" of very light material the difference in the flash points will be relatively large because the small amount of light material can vaporize and be lost from the somewhat open-type testers such as the Foster. However, if the material is well fractionated (exhibits a smooth distillation curve even at low percentages distilled) only a small difference in flash points will be exhibited when using different instruments.

Few data are available on the Foster tester because it is now obsolete. However, Dr. C. K. Francis on the Questions on Technology page of December 28, 1933 (page 243) states that for better grades of kerosine, the Foster flash point is higher than the Tagliabue flash point by 2° to 6° F. Likewise, pages 798 and 803 of Vol. 3 of Sir Boverton Redwood's "A Treatise on Petroleum," fifth edition, 1926, gives similar data as follows:

Francis	2°-6° F.
Redwood, usually	8°-12° F.
Redwood, occasionally	4°-8° F.

Such variations are properly what should be expected.

With respect to other instruments, David T. Day's "Handbook of the Petroleum Industry," Vol. 1, page 624 (1922) shows the relationship of Table 1.

Finally, the "Handbook of Petroleum, Asphalt, and Natural Gas," by the late Roy Cross of the Kansas City Testing Laboratory (1928) shows information as follows on page 662:

A.S.T.M. closed (Tag)	100° F.
Elliott or N. Y. closed	100°-105° F.
Abel	102°-106° F.
Abel-Pensky	102°-105° F.
Pensky-Martens	102°-106° F.
Tag open cup	108°-112° F.
Cleveland open cup	110°-115° F.

TABLE 1—COMPARISON OF FLASH TESTS BY DIFFERENT INSTRUMENTS

Material—	Abel	Tag closed tester	Elliott	Pensky-Martens	Cleveland open cup	Luchaire* (French)	Fire test
Naphtha	86	92	92	95	100	100	110
Naphtha	94	103	98	105	115	122	130
Water-white kerosine	127	130	128	135	140	138	160
Petrolite	142	139	140	150	155	144	175
Gas oil	...	...	...	195	200	198	220
300 oil	...	...	...	255	265	266	305
Straw oil	...	...	...	315	325	322	385
Ice-machine oil	...	...	...	400	385	402	460
Engine oil	...	...	...	430	440	430	515
Cylinder oil	...	...	...	505	525	507	610
Heavy cylinder oil	...	...	...	510	560	510	635

*The Luchaire flash points have been calculated to Fahrenheit.

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Gas Analyzers for Industrial Control and Protection

*by J. M. Lewis**

AN ever-increasing number of applications is being found for combustible-gas analyzers, ranging from detection of leaks and dangerous concentrations of combustible gases to the automatic control of processes for analyses of these atmospheres. These analyzers are operable from —80° to 165° F.

In principle, combustible-gas analyzers, such as the explosion-proof type shown, operate by drawing a sample of the atmosphere in question into the analysis cell by an aspirating means, such as the turbocompressor shown, or by a fan.

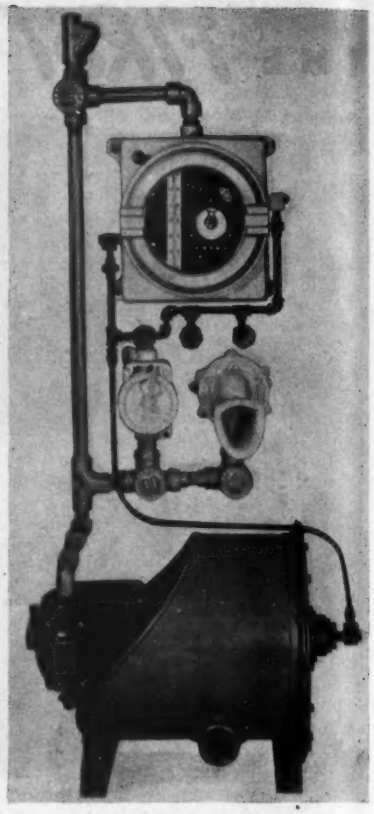
A portion of the gaseous sample brought to the analyzer is drawn over one of two heated sensitized platinum filaments making up the detecting unit. A second platinum filament unit, known as a compensator, is sealed in a reference cell.

The detector and compensator filaments form part of a balanced electrical circuit. An air sample containing a combustible will burn when passed over the hot filament of the detector unit, causing an increase in temperature and in the resistance of the platinum wire of the detector unit. This increase in the resistance of the detector filament unbalances the electrical bridge circuit in proportion to the concentration of combustibles in the sample. Amount of electrical unbalance is measured by an indicating meter so designed that when the pointer is deflected to a preset point, a contact is made which energizes the alarm circuit.

Calibration is normally for the particular gas or vapor for which the analyzer is to be used. The unit will respond, however, to other combustible gases found in industrial processes. The measuring circuit is constructed so that the warning signal can be energized at any predetermined point within a wide range by means of a convenient adjustment. Instrumentation can be provided so a continuous graphic record of the combustible gas concentration in a process atmosphere can be obtained.

Some of the applications of the analyzers are for power plants. For example, any leakage around hydrogen-cooled generators is extremely hazardous, hydrogen being a very explosive gas. The combustible-gas analyzer indicates the presence of a leak immediately and obviously per-

*Mine Safety Appliances Co., Pittsburgh.



Gas-analysis cell and sampling equipment

forms an important safety function. In engine testing laboratories, application for the combustible-gas analyzer is found in immediately determining the existence of any dangerous fuel leaks. For oil refineries, combustion safeguards are necessary in connection with catalytic cracking, catalytic polymerization, and hydrogenation. The unit is useful in checking leaks from process piping, heat exchangers, catalyst cases, etc. The "checking" of storage conditions and oil tankers is another application.

Hazardous concentrations of carbon monoxide are shown in the accompanying chart.

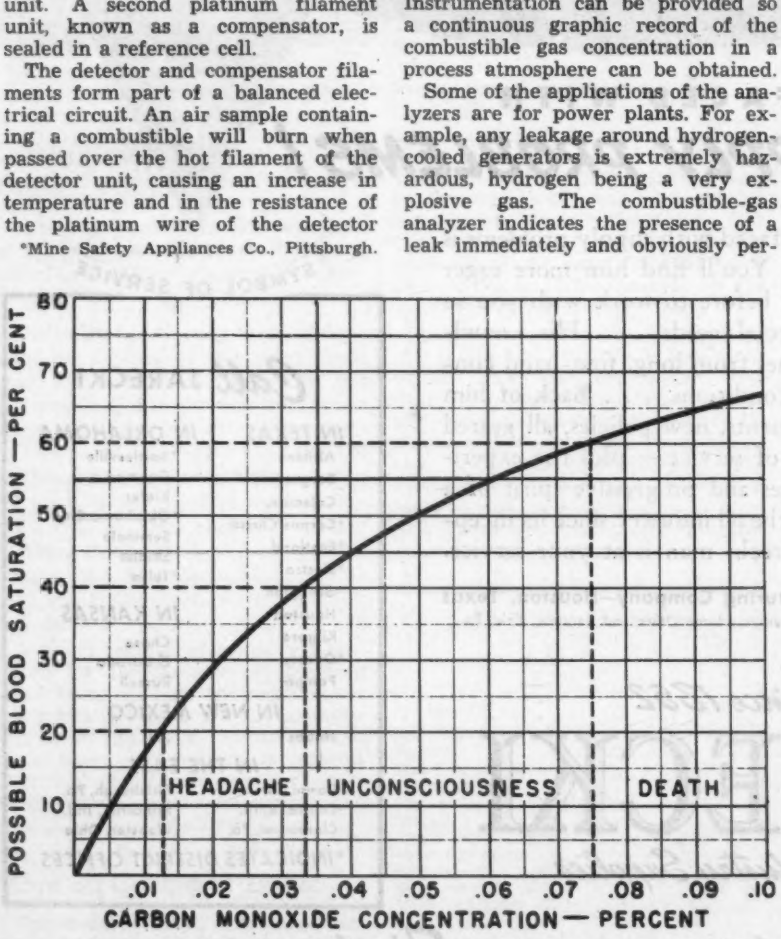


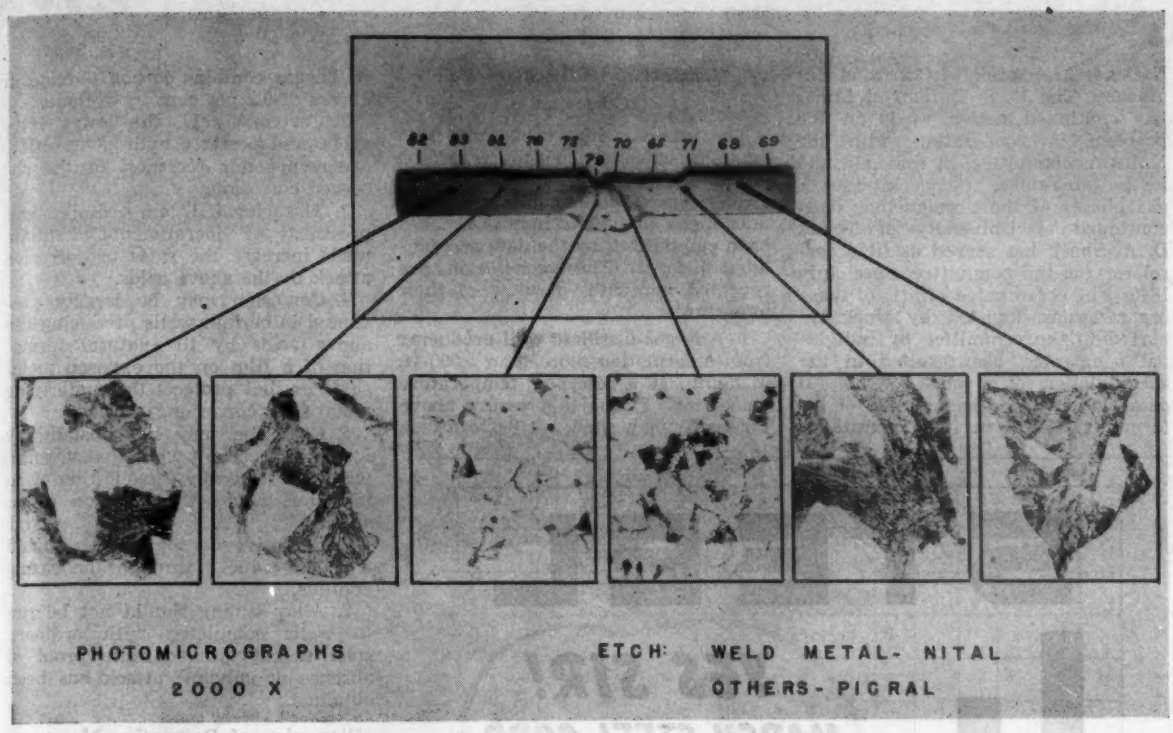
Chart showing hazardous concentrations of carbon monoxide

Oxygen and CO Recorders

Oxygen concentration is measured by supplying a sample flow to the detector cell of the oxygen indicator. The detector cell is essentially a primary cell having one metallic electrode and one hollow carbon electrode immersed in the electrolyte. The hydrogen evolved at the hollow carbon electrode causes polarization of the cell, decreasing and generated e.m.f.

The sample flow being measured is passed through the hollow carbon electrode where any oxygen which is present in the sample diffuses through the wall of the carbon electrode and combines with the hydrogen evolved. This produces a depolarization effect in the cell, in proportion

(Continued on page 276)



Above: Localized corrosion around weld in straight section of condensate-well flow line. Numerals indicate Rockwell B hardness corresponding to indentations seen in cross-section. Edge of localized corrosion corresponds on both sides of weld to change from normal lamellar pearlitic structure of pipe (lower left and lower right) to a heat-affected distorted pearlitic structure (second from either end below). Low-carbon iron in weld (third from left) most rapidly corroded. Fine-grained structure near weld not resistant to corrosion. (Courtesy Phillips Petroleum Co.)

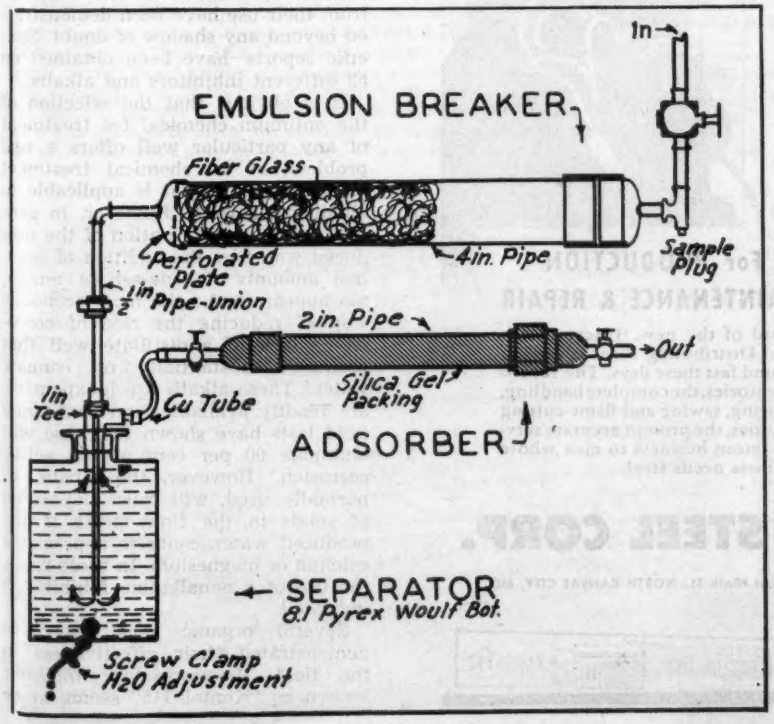
Review of N.G.A.A. Research on Gas-Condensate-Well Corrosion

by T. S. Bacon*

PURPOSE of this report is to review, in general terms, the activities and accomplishments of a cooperative research project concerned with the study of corrosion in gas-condensate wells. This study is sponsored by the Natural Gasoline Association of America. The history and accomplishments of the committee since its organization in April 1944, through April 1946, were reported[1] at the N.G.A.A. twenty-fifth anniversary convention in Dallas. The present report will attempt to summarize the accomplishments of this committee during the past year.

Active work on the serious problem of distillate-well corrosion has been continued during the past year with the continuing cooperation of corrosion committees of the American Petroleum Institute and of the

*Lone Star Producing Co. Presented at the Natural Gasoline Association of America's twenty-sixth annual convention, Dallas.



Arrangement of N.G.A.A. silica gel extractor equipment used in field to concentrate and collect naturally occurring polar compounds for laboratory observations

National Association of Corrosion Engineers. The U. S. Bureau of Mines has continued active work on the problem in cooperation with the N.G.A.A. committee, in the field and in the laboratory, and work on various phases of the problem has been continued at University of Texas. D. A. Shock has served as field correlator for the committee since July 1946. The coordinated efforts of these organizations, assisted by work reported to the committee by individual companies, has resulted in the accumulation of a mass of helpful data, and in the dissemination of information useful in field operations.

Conclusions on Distillate Well Corrosion

The previous report of April 1946 contains seven conclusions regarding gas-distillate wells and their corrosive effects. These conclusions remain unchanged and their importance has been emphasized by the data accumulated this year. These conclusions are repeated herewith, in view of their importance:

1. Any gas-distillate well producing from a formation more than 5,000 ft. in depth, at a reservoir temperature above 160° F., and a pressure above 1,500 psi., may show corrosive attack if the gas contains carbon dioxide in excess of 0.2 per cent by volume.

2. Carbonic acid, the lower fatty acids, and possibly hydrogen sulfide, are responsible for most of the observed corrosion.

3. The elevated temperatures and pressures of operation of distillate wells increase the rates of corrosive attack by the above acids.

4. Corrosion may be largely prevented in certain wells producing the above acids by the natural formation of a film on the exposed metal surfaces that protects the underlying metal from corrosion.

5. Corrosion may be substantially reduced in certain wells that are naturally corrosive by the addition of an inhibitor, or by the addition of an alkali.

6. Corrosive distillate wells should not be produced through the casing annulus.

7. Alloy tubing should not be run in wells completed with ordinary steel casing until definite proof of absence of galvanic attack has been obtained.

Discussion of Preventive Measures

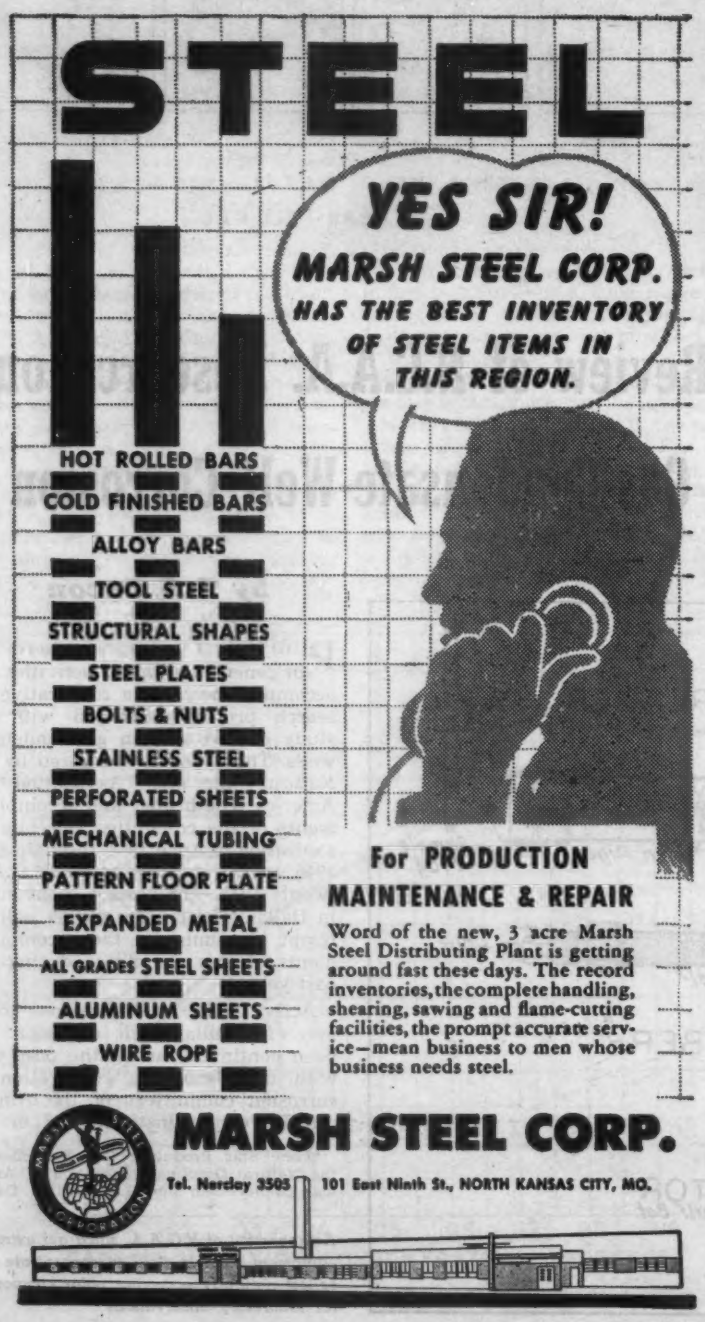
Preventive measures presently in use in the field may be divided into three general classes, as follow:

1. Use of chemical compounds as inhibitors or neutralizers.
2. Use of protective coatings.
3. Use of alloys.

Chemical treatment.—A vast amount of factual information obtained during the past year has confirmed the effectiveness of chemical treatments. Inhibitors and alkalis are being used in many producing fields, and the practical benefits obtained from their use have been demonstrated beyond any shadow of doubt. Specific reports[3] have been obtained on 52 different inhibitors and alkalis.

It is obvious that the selection of the optimum chemical for treatment of any particular well offers a real problem, as no chemical treatment has been found that is applicable to all distillate wells. However, in general, partial neutralization of the produced water by the addition of nominal amounts of soda-ash or ammonia appears to be the most economic way of reducing the rate of corrosive attack of a distillate well that produces substantially no connate water.[3] These alkalis are inexpensive, are readily available, and continuing field tests have shown their use will eliminate 90 per cent of the active corrosion.[4] However, the alkalis, as normally used, will cause deposition of solids in the flow string if the produced water contains appreciable calcium or magnesium. In these cases, the use of a nonalkaline inhibitor is indicated.

Several organic inhibitors have demonstrated their effectiveness in the field. A proprietory inhibitor known as "Kontol 115" seems to be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Baash-Ross News

BAASH-ROSS TOOL COMPANY · LOS ANGELES · HOUSTON · NEW YORK

OUR 27th YEAR

...and again something new from BAASH-ROSS

Baash-Ross Type "UC" Casing Slips

BECAUSE A STRING of casing has a relatively thin wall in relation to its diameter, it is much more easily damaged by unequal slip pressure than are drill pipe or tubing. Yet the weight of a string of casing—particularly under modern deep-hole drilling operations—can be extremely great... *so great, in fact, that even a slight misalignment of the slips or a moderate concentration of slip pressure can cause serious damage to the casing and might even result in losing the casing string down the hole.*

But such risks are now minimized through development by Baash-Ross of a new type of casing slip—the Baash-Ross Type "UC" Casing Slip. The Type "UC" Casing Slip consists of multiple segments, flexibly linked together so that they *w-r-a-p* around the casing like a chain tong to fit the exact curvature of the casing. Each individual slip segment takes the *same* uniform grip on the surface of the casing because *all* of the segments are unitized together—*act* as a unit, *set* as a unit, *grip* as a unit. This assures uniform slip pressure around the full circumference of the casing, eliminating risk of concentrated pressures that crimp the pipe and egg-shape the casing.

THREE BASIC BODY SIZES HANDLE WIDE RANGE OF CASING DIAMETERS

And here's an important point... Only *three* basic body sizes of "UC" Casing Slips are needed to handle *all* popular casing sizes from 7⅝" through 13⅜". As shown in the accompanying table, interchangeable liners are available for each of the three basic body sizes so that each size can be readily adapted to fit different casing sizes within its operating range...

Basic Body Size "UC" Casing Slips....	13⅜"	10¾"	9"*
Interchangeable liners available to fit.....	13⅜" 11¾"	10¾" 9⅝"	9" 8⅝" 7⅝"

**Fits bore and taper of standard rotary table.*

LINERS EASILY REPLACED

The liners in "UC" Casing Slips have ample length and are so designed that they will cut through pipe scale and any surface coating on the casing to take a firm, slip-proof grip *without damaging the surface of the casing itself.*

And if at any time after long usage, the liners become dull—or when changing from one casing size to another as outlined above—they can be quickly and inexpensively replaced. Simply pull a stainless steel pin, replace the old liner with a new one, slide the pin back in place and the job is done. The stainless steel pins eliminate risk of corrosion and assure easy liner replacements. Furthermore, it is important to note that none of the load of supporting the casing string is placed on retaining pins, bolts or any other parts that can become sheared or lost in the hole. *For maximum safety and strength all weight on the liners is transferred directly to the Slip body itself!*

HERE IS WHY *every casing job needs the protection of Baash-Ross "UC" Casing Slips!*

Because casing has a thin wall in relation to its diameter, it is easily crimped or damaged by even small misalignments that would not affect thicker-walled drill pipe or tubing.

If casing diameters vary slightly or if the slips are not set at exactly the same level, conventional rigid-type slips cause concentrated slip pressure that can crimp, bottle-neck or squeeze the casing out-of-round.

Such damage not only risks dropping the casing string, but the bulged or egg-shaped areas can cause poor joint make-up as well as tight spots through which tools cannot pass. Moreover, wear concentrated on the bulged spot leads to premature casing failures.

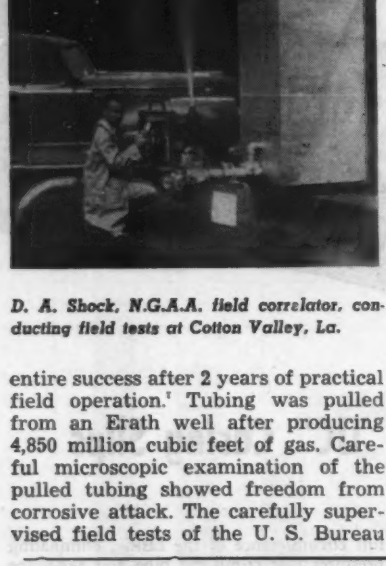
The flexible unitized design of Baash-Ross Type "UC" Casing Slips eliminates risk of one portion setting higher or lower than the other... and the multiple narrow segments assure an accurate, safe grip that exactly fits the curvature of the casing.

RESULT—there is no concentrated slip pressure—no misalignment of slip segments—no risk of damaging the thin walls of even the longest and heaviest casing strings!

Type "UC" Casing Slips are light, compact and easy for the crew to handle on even the longest and heaviest casing jobs. And they are so inexpensive that every casing job you run can have the protection of this new slip advancement. Your nearest Baash-Ross representative will be glad to supply full details... or write direct.

particularly effective, but bone oil and naphthenic acids have also shown encouraging results.[5,6]

Sodium dichromate as an inhibitor continues in use at Erath, La., with



D. A. Shock, N.G.A.A. field correlator, conducting field tests at Cotton Valley, La.

entire success after 2 years of practical field operation.[7] Tubing was pulled from an Erath well after producing 4,850 million cubic feet of gas. Careful microscopic examination of the pulled tubing showed freedom from corrosive attack. The carefully supervised field tests of the U. S. Bureau of Mines at Cotton Valley, La., indicate that sodium chromate solutions will effectively inhibit corrosion in that field and that plugging of the producing string can be avoided if the chromate is injected in sufficient dilute solution.[8] So it seems reasonable to assume that a method of chemical treatment can be selected that will be effective in any distillate well.

Chemical treatment methods have been used successfully only in singly completed wells. Work is continuing on the development of methods for chemical treatment of dually completed wells, but this work has not yet reached a stage of perfection that would permit its general application in the field.

Protective coatings.—New types of protective coatings are undergoing field exposure tests, particularly as used to protect tubing strings. The most widely used protective coating is a plastic-type synthetic paint that is applied to metal surfaces after careful preparation of the surfaces by pickling and sand blasting. The paint is baked after application and is applied in several coats. Cost of application is rather high, but it appears that sufficient protection may be afforded in some instances to more than justify the added cost of the coating. Some tubing strings so protected have been in service for several months with no reported deterioration of the protective coating.[4] Such coatings apparently are ineffective when applied to chokes, due to the effect of high turbulence on the coating. Such coatings are of questionable value when applied to christmas-tree fittings, again probably due to the adverse effects of turbulence on coatings in such locations.

Alloys.—Alloys are finding increasing use in the field, particularly in master valves, and also in wing valves and in christmas-tree fittings. Several 12 per cent chrome-iron trees are in service in the field, and present reports indicate that no observable corrosion has been evidenced in any of these trees, after several months of service. Master valves, either made of resistant alloy throughout, or lined with resistant alloy, or plated with resistant metals, have been used in the field. Many alloys have been used in fabrication and most of these are showing satisfactory resistance to actual corrosive conditions; 18-8 stainless steels, the monels, and bronzes, seem particularly suitable for this service.

N.A.C.E. Developing Method

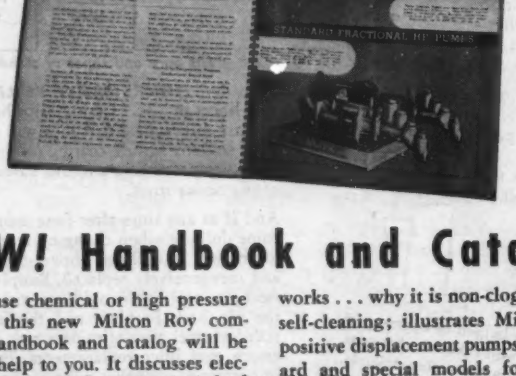
The National Association of Corrosion Engineers is developing a method of field evaluation of alloys. Seven alloy coupon bombs are undergoing installation in various fields presently.[9] No data on relative resistance of the 32 different alloys to be exposed in each of these bombs are available at present, but it is estimated that this information will be available within the next several months.

The U. S. Bureau of Mines has run exhaustive laboratory tests on the evaluation of alloys. Results of this work on 70 different alloys are definitely discouraging in that no low-cost alloy showed promise in resisting corrosive attack by carbonic acid, propionic acid, or phenols.[10] It appears from these tests and other observations that at least 9 per cent of chromium or 9 per cent of nickel is required to improve materially the corrosion-resisting properties of ferrous alloys.

Special corrosion-resisting alloys have been used largely by the chemical industry in the past, and on a restricted-volume basis. It is possible that substantial reductions in the costs of some of the corrosion-resisting alloys might be made if alloys could be used on the large tonnage basis that would be required if they were found economic for use in distillate field operations. This question of reduced cost is under discussion with the alloy manufacturers presently, in an attempt to avoid rejection of any alloy of a current price basis if that rejection would be unjustified due to price reductions that might be made on a tonnage basis.

Some attention has been given to modification of corrosion-resisting

MILTON Roy PUMPS



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properties of the usual low-carbon steels now used by the oil industry by heat treatment of these steels. It has been demonstrated in the laboratory and elsewhere that heat treatment can modify the corrosion-resisting properties of low-carbon steels very materially. The familiar "ringworm" corrosion that has been so widely evidenced may be taken as an example of the effect of heat treatment on corrosion-resisting properties of upset tubing. The metallurgists tell us that the metal structure at the transition zone at the base of the upset is different from that in the tubing itself, and also different from that in the upset.[11] Corrosive attack often concentrates in this transition zone and therefore probably is affected by the metal structure in that zone. Welds also affect metal structure and corrosion resistance (see illustrations of photomicrographs). It appears that further study of this method of approach might produce information that would be extremely helpful to the industry.

Try to Define Causes

Importance of considering corrosion resistance as one of the specifications on tubular goods used by the oil industry has been emphasized by the committee. As an example, the physical specifications on N-80 tubing exceed those of J-55 tubing. However, it has been found that N-80 tubing is more subject to corrosion in some instances than is J-55 tubing, so that the benefits of the increased physical properties of the N-80 tubing may be offset by the decrease in resistance to corrosion.

The committee has expended much of its effort and much of its finances in an attempt to define the causes of distillate-well corrosion. The theoretical scientist has contributed a great deal to our present knowledge of these causes, and this present knowledge has been helpful in guiding the field trials of remedial measures.[12]

A considerable portion of the committee funds has been expended on a study of inhibitors. There is a rather surprising lack of information in the corrosion literature on the specific actions of inhibitors, particularly in the absence of oxygen and at elevated temperatures. The economic advantages to be gained from the use of the proper inhibitor in corrosive distillate wells have been strongly emphasized

The probability of the occurrence of natural inhibitors in certain distillate wells has also been emphasized. These natural inhibitors seem to be extremely effective, and therefore it seems desirable to attempt to determine their chemical composition so that similar inhibitors could be manufactured and used to treat corrosive wells. Dr. H. L. Lochte is attempting to determine the acidic, ketonic, and phenolic, compounds that are present in minute amounts in distillate produced from corrosive and noncorrosive wells in the hope that some clues might be obtained that would point toward the chemical nature of the naturally occurring inhibitors (see accompanying photographs of sampler). Dr. Norman Hackerman is studying the action of known inhibitors, and is attempting to devise more satisfactory methods for evaluation of inhibitors, and more satisfactory theories to explain the actions of inhibitors. It is interesting to note that the use of naphthenic acid as an inhibitor in the field was suggested on the basis of work by Lochte, Hackerman and Shock. It seems reasonable to anticipate that continuation of this work might produce results that would have great practical value.

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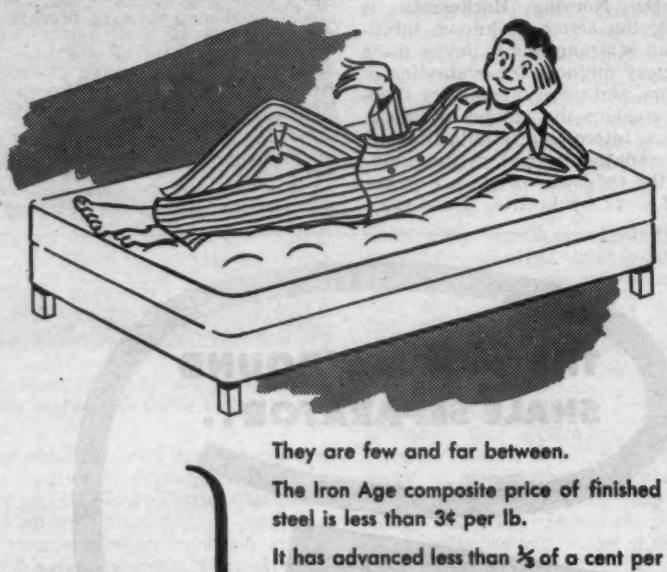

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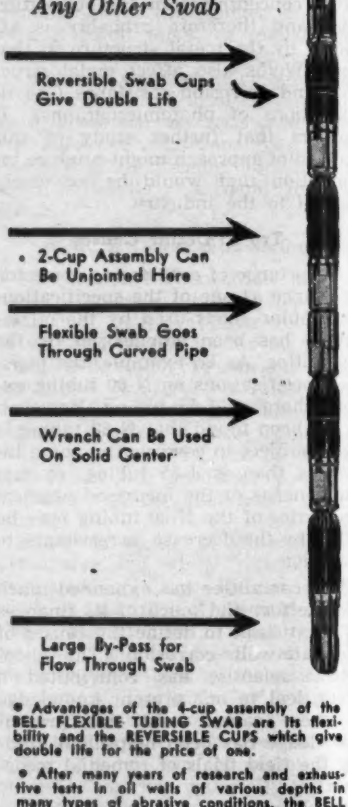
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BOOKS

AIR CONDITIONING AND ELEMENTS OF REFRIGERATION. By Samuel P. Brown. Published by McGraw-Hill Book Co., New York. 644 pp. $6.

This book shows how to calculate heating and cooling loads, and how to heat, cool, ventilate, and otherwise condition air in any building. Selection of equipment, automatic controls, and the design of air ducts and liquid piping systems are thoroughly covered. Refrigeration theory, application, and equipment selection are also included. The book contains all the tables necessary for elementary design work, although complex theory and higher mathematics have been eliminated. It is a good reference book for those actively engaged in air-conditioning and refrigeration work, and will be a valuable guide to those entering the field.

A GENERATION OF INDUSTRIAL PEACE. By Stuart P. Chase. Published by Standard Oil Co. (New Jersey). 63 pp.

This little volume presents a searching examination of Jersey's labor relations. The author, writer on economics and related subjects who has an abiding interest in the impact of science of machinery on human beings, was invited to survey the company's industrial relations and report his findings in the company's magazine. He was assured complete freedom to reach his own conclusions, whether favorable or otherwise to the company. He visited refineries and chatted with union leaders and representatives of management. The story he wrote is one primarily of a philosophy, rather than a mechanism, which has enabled men to work with men in peace for a generation.

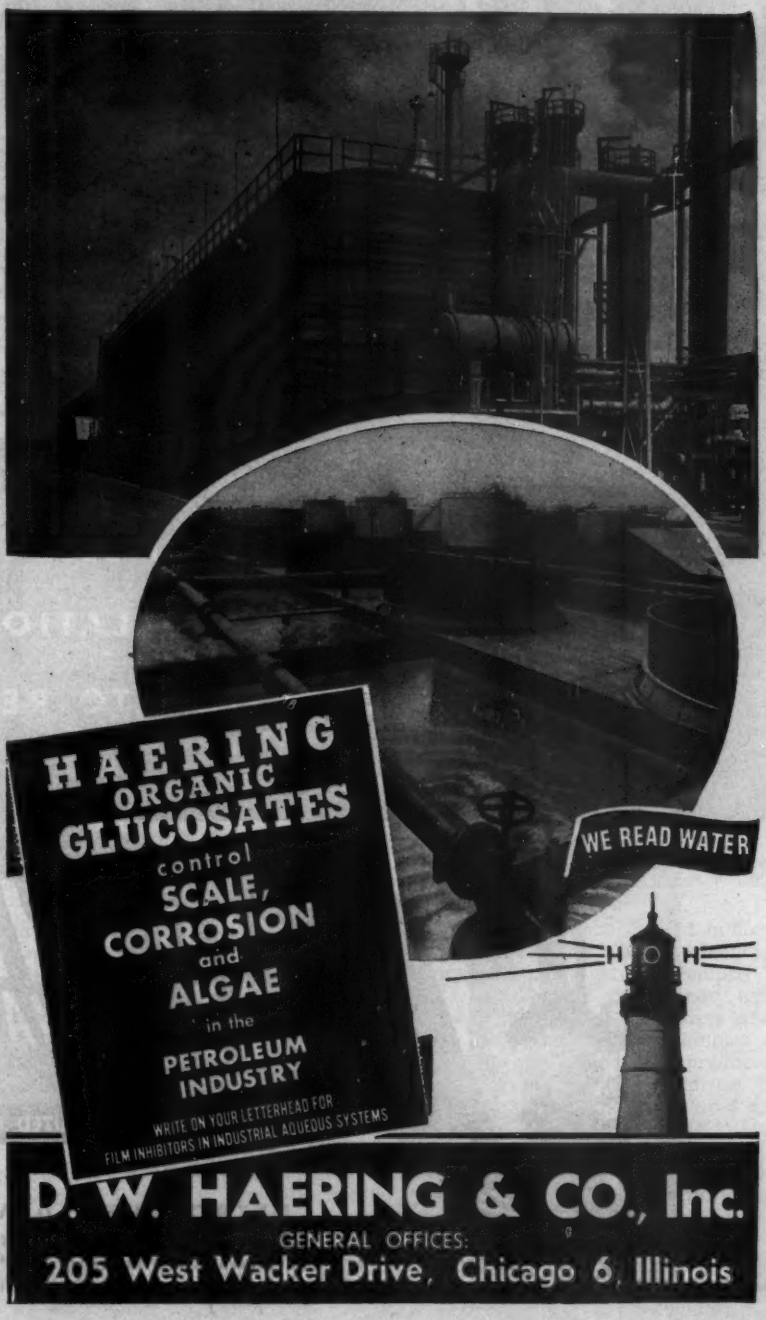
"EARLY GEOPHYSICAL PAPERS OF THE SOCIETY OF EXPLORATION GEOPHYSICISTS." Compiled and printed, 1947, Society of Exploration Geophysicists, P. O. Box 1614, Tulsa. $6.00.

Prior to January 1936, papers presented at meetings of the Society of Exploration Geophysicists were published in various scattered places, including the bulletin of the American Association of Petroleum Geologists, Physics, as "Special Papers" in mimeograph form, and in an early publication entitled "Journal of the Society of Petroleum Geophysicists." Since January 1936, all papers have appeared in the quarterly bulletin, Geophysics, of the S.E.G.

These early papers contain much of the history and technical fundamentals of the present geophysical exploration industry. To preserve them and make them conveniently available to geophysicists throughout the world, and particularly to the many younger members, the S.E.G. executive committee has arranged for republication in one bound volume.

AMERICAN OIL OPERATIONS ABROAD. By Leonard M. Fanning. Published by McGraw-Hill Book Co., Inc., New York. 289 pp. $5.

Timeliness of this book is spotlighted by the statement "too little understood is the place in our modern economy occupied by the American oil companies operating abroad," a quotation from the January 31, 1947, final report of the Senate special investigating committee investigating petroleum resources. The book should do much to clear up any misunderstandings as to the facts. It is a comprehensive, factual history of all important American oil operations abroad from their beginnings early in this century right up to the present, when Middle East oil—and all foreign oil—are taking on added importance. Particularly revealing are the facts about the large risks and investments, and the long periods of arduous work needed to find and develop foreign oil fields. Equally interesting are the accounts of the political background of foreign oil developments. In all foreign countries, American interests have a total investment of nearly 2½ billion dollars. The book traces the diplomatic and operational history behind these invertments. There are 96 pages of pictures in the book.



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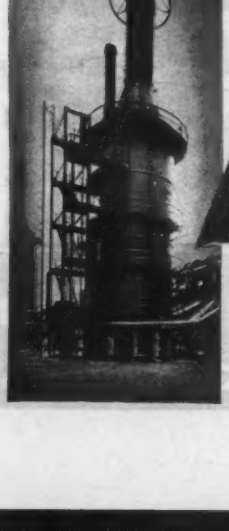

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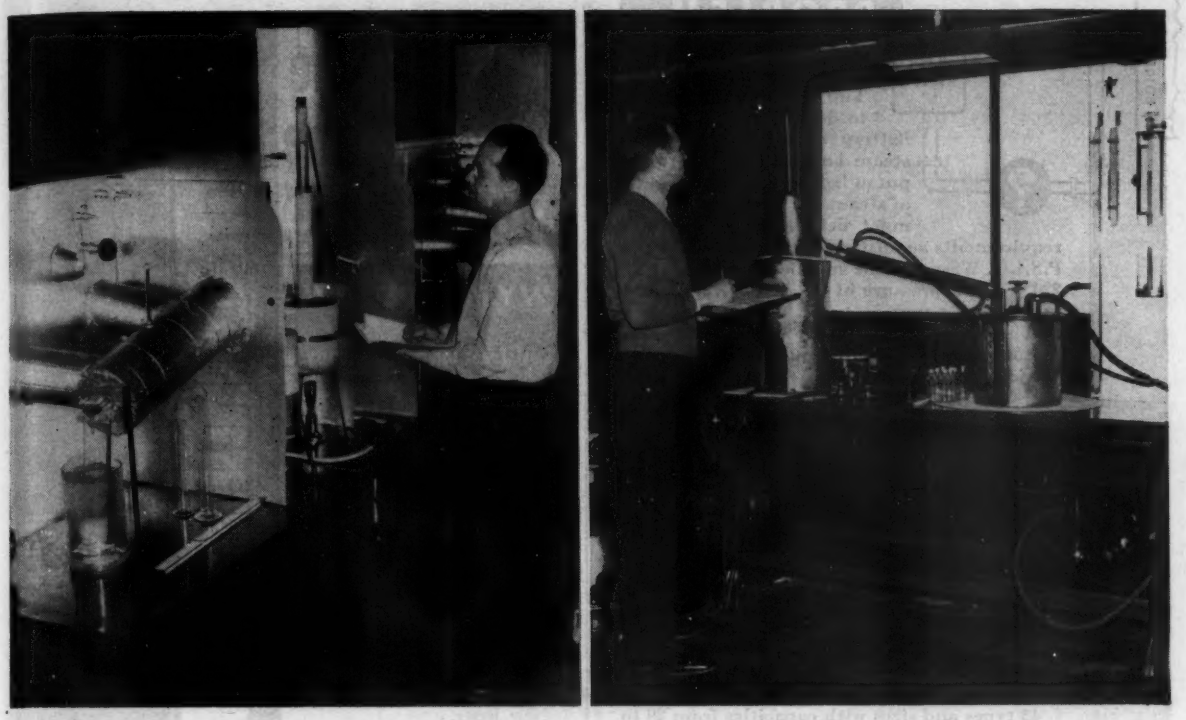


Left: Stills and condensers in laboratory of Gulf Oil Corp.'s refinery technology division, Philadelphia. Right: High-Vacuum distilling equipment in laboratory

THOUSANDS OF

Samples From Oil Wells Analyzed

As Aid in Refining Operations

by Herschel G. Smith*

AS many as 1,500 samples of crude oils from all over the world are being tested yearly by Gulf Oil Corp. as an aid in classification and selection of the best crude oils for making higher-quality petroleum products with minimum complications for the refinery operations. This work has been going on in Gulf laboratories for over 20 years. The large cross-indexed file on this work, developed and carried in the office of the refinery technology division for so many years, has become a very comprehensive and valuable reference file or "library" on the properties of crude oils of the world, perhaps the largest file ever developed on this subject.

These laboratory activities have become of more and more importance from year to year, due to the fact that "all crude oil is not the same." Some crude oils are suitable merely for the production of fuel oils, while others yield a variety of high-grade lubricating oils and other valuable petroleum products.

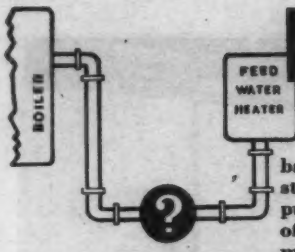
The crude oils from no two fields in the world are exactly alike, but can be classified in four major types. There will be encountered a very large number of variations or combinations of each major type of crude.

The proper classification and segregation of the different types of crudes is of extreme value to a large petroleum refiner, due to the fact that, by such activities, the crudes can be sorted and segregated so as to provide maximum yields of the highest quality of products without prohibitive refining expense, with available equipment in each refinery. For each major type of crude there will be encountered a number of subclasses or types that are at times of special interest. Thus, it can be seen that the details become extremely involved in refinery program aimed at the production of hundreds of different petroleum products from a large variety of crude oils.

Sample from each well of interest, as brought in by Gulf's production companies, is forwarded promptly to the laboratory of Gulf's refinery technology division for preliminary analysis and classification. Samples of wells brought in by other producers, if of possible direct or indirect interest to Gulf, are also secured and forwarded on this program.

Rapid preliminary analysis of each sample is carried out by simplified laboratory methods. The information thus quickly developed enables Gulf laboratories to classify each crude of interest and to make a preliminary estimate of the approximate value and

*Manager, refinery technology division, Gulf Oil Corp.



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Two pumps are required to deliver feed water to a battery of medium pressure steam boilers. Maximum output of boilers is 150,000 pounds of steam per hour. Each pump must deliver full feed water requirements against an outlet pressure of 260 P.S.I.G. Water will be supplied from heater at 220° F. at a pressure of 9½ P.S.I.G. at pump inlet. One pump is to be driven by steam turbine; the second, by a 60 cycle electric motor. Which Goulds pump is *the* pump for *the* job?

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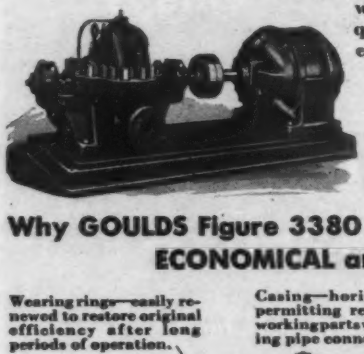

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expected yields of different types of products.

Samples from the southwestern area (Texas and Louisiana) are usually sent to the Port Arthur branch of the refinery technology division's crude-oil laboratories, as a matter of expediency and economy; while samples from all other parts of the country, as well as from foreign fields, are sent to the central laboratory at Philadelphia. In both laboratories exactly the same details are applied as to procedure and methods for analysis and classification, and the results developed at Port Arthur are sent by air mail to Philadelphia, where all the reports are studied further, printed, and distributed promptly to all interested departments.

A prompt analysis is required for every new oil strike, whether from a developed producing area or a lone wildcat venture. The tests made show very significant variations in the properties of crude oils, even for wells in neighboring fields and often for wells from the same field from different sands, zones, or depths. The oils will range from heavy asphaltic types of crudes, that are so heavy and viscous as not to flow readily through pipe lines, to very light crudes so volatile as to approach the characteristics of a natural gasoline.

In general, the variation in a crude from a given sand or zone of an established field is usually so slight for different samples that a simple check suffices to confirm the location or depth from which the crude has been taken. Thus, frequently the information developed by tests of samples is employed by the crude producers to confirm or indicate the producing zone from which the crude came, or for tracing the continuity of oil-producing formations.

More involved and detailed analyses of larger volume samples follow the preliminary work in the case of new fields of considerable probable potential value or in the case of new supplies available to a refinery. The extension of activities along these lines goes so far as to include practically complete experimental refining operations, for the production of appreciable volumes of finished products for tests and demonstration purposes, in the "semiworks" laboratory at Philadelphia.

On the basis of preliminary, high-speed tests, which can be completed in but a few days after the receipt of each sample, plans are developed, even for distant producing fields, covering the best handling procedures for the particular crudes. The production and pipe-line operators then deliver the classified crudes by the "block" system in the pipe lines. Thus, large-volume supplies of a given type, as needed for certain refining operations and products, are segregated and blocked through the pipe lines, and are handled separately until the

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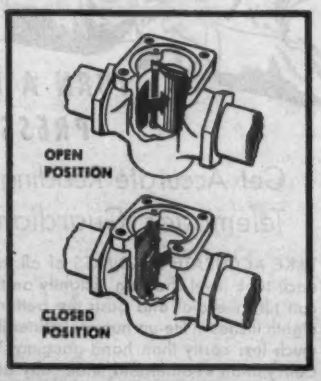

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final workup of each block of crude into finished products at a refinery.

By classification and segregation program, and the separate shipment and delivery of certain selected crude oils of the highest quality, considerable economies in refining can be applied; while new processes and products may even be developed to take advantage of the particular quality of a certain class or type of crude oil. By exactly classifying all well types and arranging a refinery so as to handle most efficiently the various segregated classes, the maximum value can be secured from each type of oil at minimum refining cost.

Testing and segregation data for Gulf wells all over the world are developed in the still rooms of the refinery technology division at Philadelphia and Port Arthur.

The most important types of crude oils classified by this system are as follows: the highly paraffinic types, usually containing some paraffin wax (such as Pennsylvania crude and the deep sand, Ordovician, West Texas crude); mixed naphthene - paraffin types, usually containing some paraf fin wax and somewhat greater amount of asphaltic material in the heavy ends, such as the usual Mid-Continent crude; naphthenic types containing little or no paraffin wax, such as the many Texas Coastal crudes; heavy asphaltic types for which the light components are usually mixed naphthene-paraffin type (although either type may predominate), for which there is large content of asphaltic material, such as the heavy Western Venezuela crude, heavy Mexican crude, and many heavy California crudes. However, as previously noted, the number of combinations of varieties is very large, and crudes are usually classified according to the predominating characteristics. In general, it may be said that all crude oils are mixtures of hydrocarbons of practically all types, while the classification will hinge upon the predominating type of hydrocarbons in a given crude mixture.

In carrying out the rapid preliminary crude analysis, a sample of crude oil is tested for gravity, specific gravity, viscosity, flash point, pouring and pumping characteristics, color, sulfur content, water and salt-water contamination, and other special tests applied directly to the crude oil, as well as routine distillation tests for indicating the probable yields of motor gasoline, kerosine, lubricating oils, and fuel oils; with further tests carried out on the fractions distilled in testing the crude oil, as indicative of the relative value and properties of these fractions, such as gravity, sulfur, and distillation characteristics of the gasoline and kerosine fractions, and the properties of the heavy residuum as regards gravity, viscosity pour test (indicative of paraffin wax content), sulfur, fixed carbon or carbon-residue values. After this preliminary work is carried out, a special number rating classification system is applied to each crude oil, indicative of the comparative value as regards gasoline and kerosine content degree of paraffinicity or naphthenicity, the total paraffin wax content, and the approximate amount of asphaltic material in the crude.

The laboratories have developed so much experience in interpretation of the preliminary test data as to be able to dish up a duplicate for any crude oil, which could not be readily distinguished from the original crude-oil sample, even by an expert, i merely provided with the simplified preliminary report on the crude, including the classification number rating system.

Gas Field Hearing Set

The Texas Railroad Commission has set September 4 as the date for a hearing to determine whether or not Panhandle gas field should be prorated as one field.

The hearing, to be held in Amarillo, will take evidence on whether the market demand for sweet and sour gas should be combined and this market demand prorated ratably to all wells in the field, regardless of the zone from which production is obtained.

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Trends in Drilling Equipment and Costs

(Continued from page 221)

in rotary hydraulic systems.

Recent application of diamond bits in coring of hard sandstones, use of long strings of drill collars in drilling of hard formations, and experimental use of electric motors to drill extremely hard cherts likewise should bring additional improvements in rotary-drilling techniques.

In the light of these developments and possible new inventions it appears that the industry can confidently expect suitable equipment and necessary know-how in meeting the physical problems of drilling at greater depths. The problem, however, is somewhat different when cost factors are injected and the whole problem is treated from the economic as well as physical point of view—particularly in relation to drilling deep wells.

Drilling-Cost Trends

Oil-well drilling costs continue to move upward. Estimates show that in 1946 there was another increase in the average drilling cost, despite the fact that there was practically no increase in average well depth.

Fig. 1 was prepared to show average well-drilling costs for a group of companies reported by Chase National Bank. The chart shows an upward trend of drilling costs which in general parallels a similar trend in the average drilling depth. Present trend in drilling costs started in 1941, or the year in which an upward trend in drilling depths had its beginning. During the war other causes also contributed to the high cost of drilling such as increased cost of supplies and materials, delays in procurement and poor quality of materials, and high cost and decreased efficiency of labor. It will be noted that since 1940, drilling cost of companies reported by Chase increased approximately 110 per cent.

Fig. 2 represents the trends in average depth for the industry. These figures are averages for the 14 most active states, exclusive of shallow drilling in eastern United States. Similar figures on 30 companies reported by Chase are not available and due consideration must therefore be given in comparing cost and depth trends as indicated on Figs. 1 and 2.

During the 10-year period, average depths for industry in 14 states rose from 2,814 to 3,770 ft., representing an increase of approximately 1,000 ft. Whether the upward trend in average depth will continue or will not depend upon possible discovery of large reserves at shallow depths. While such possibility cannot be ruled out, the odds favor deeper fields and increased average depth for the reason that there are more and more deep

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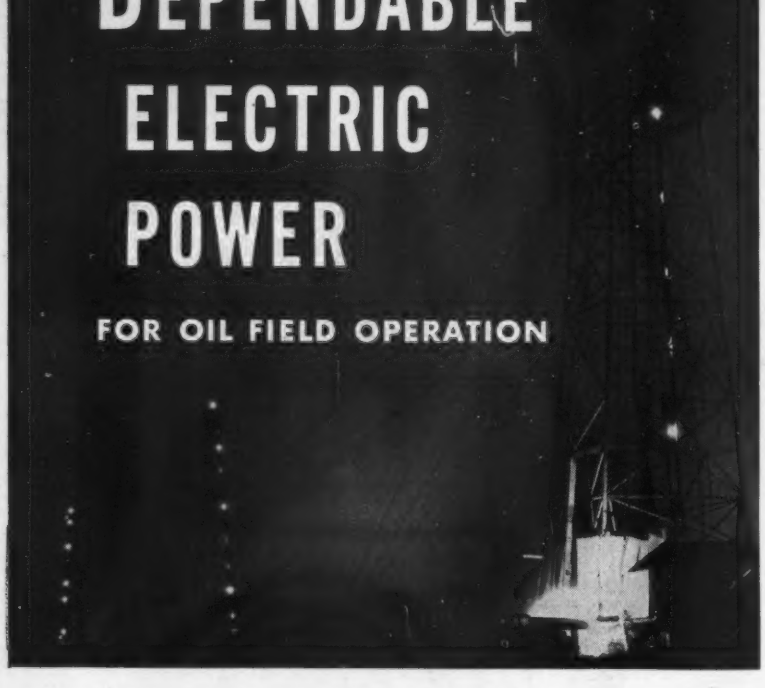

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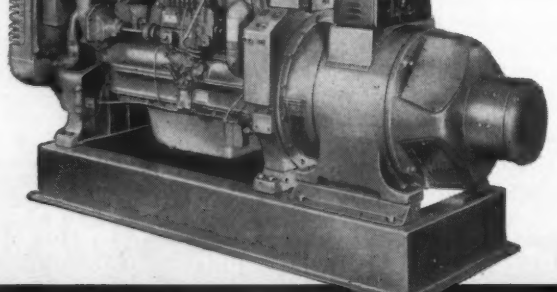

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wildcats drilled annually. Other conditions being equal, deeper wells require extra days at the well and drilling of this extra footage normally results in disproportionate increase in days and drilling costs.

It has been estimated by some that 50 per cent of the increase in drilling costs was due to increased depths and the other 50 per cent was due to other causes such as higher cost of equipment, materials, and labor. Doubtless we cannot expect a decrease in hourly wage scales. If reductions in labor costs are to be realized they must come from increased labor productivity or through higher efficiency of drilling operations.

Likewise, neither manufacturers nor drilling contractors expect that there will be any substantial reduction in material and labor cost. Any reduction in their cost therefore must also come from higher productivity of labor or through increased efficiency. Thus it would appear that with expected increase in average drilling depth, drilling costs will continue to rise unless such increases can be matched by increased efficiency of drilling equipment and techniques. Need for improvements in drilling equipment and technique, therefore, cannot be overemphasized for it is one of the most important problems of the industry in tomorrow's picture.

Deep-Drilling Equipment and Costs

Now let us consider a longer-range trend in drilling equipment and costs. Pressed with ever-increasing demand for crude and unable to find sufficient reserves in shallow reservoirs, United States industry is gradually shifting its finding effort to deep drilling, and recently seaward in search of oil under the Continental Shelf. A number of prominent geologists place considerable reliance on deep-seated and Continental Shelf oil reserves. Deep wildcatting and exploration of Continental Shelf can and probably will result in discoveries and subsequently in development of deep-seated oil fields.

Fig. 3 represents progress in deep drilling. From 1936 to 1946 maximum depth of wildcats has increased from 12,786 to 16,669 ft., an increase of approximately 4,000 ft. during the 10-year period. This year the Superior Oil Co. of California wildcat in Oklahoma broke the 1946 drilling record and went to 17,823 ft., with 7-in. streamlined casing being set at 16,351 ft.

To reach the 20,000-ft. objective in drilling will require only a little more than 2,000 ft. over the present record, and it is reasonable to assume that this record will be reached before long. The producing record stands at 13,788 ft.; during the last 10-year period there have been a number of producing fields discovered between 12,000 and 14,000 ft. in depth.

As the industry enters a decade in which drilling of 20,000-ft. wells will become a reality, a bit of crystal gazing might be of interest to all in the industry. With this point in mind, a poll of manufacturers and drilling contractors was made to obtain a composite opinion of men of the industry who follow closely development in deep-drilling equipment and operations.

Equipment manufacturers tell us that deep drilling rigs capable of drilling to 20,000 ft. in depth are in design stage and may become available to the industry within 2 or 3 years. Today's trend is to adapt the present rotary system and equipment to deep drilling below 15,000 ft. in depth. Thus far it does not appear that industry can expect any new developments of revolutionary nature in drilling equipment unless unforeseen developments arise.

Both the equipment manufacturers and drilling contractors feel that wells up to 20,000 ft. in depth can be drilled with modified and improved rotary-drilling equipment of present type. Draw works, drill pipe, and bits appear to be the three principal items that give concern to contractors and manufacturers in deep drilling. Some manufacturers plan to overcome draw-works-design difficulties with twin-drum-shaft draw works. Drill-pipe manufacturers are currently experimenting with a steel having a minimum yield strength of 105,000 psi. as compared to 80,000 psi., to make the drill pipe suitable for 20,000-ft. drilling. Estimates indicate that drill pipe of this kind will cost in the nature of 75 per cent over that of N-80.

Preliminary estimates indicate that 20,000-ft. rigs including derrick and drill pipe will cost in the neighborhood of $500,000 per rig, as compared to $300,000 for 10,000-ft. rigs.

Inquiries to Drilling Contractors

A questionnaire was sent to 46 contractors, and 23, or 50 per cent, cooperated in the poll. One of the questions directed to the contractors was, "Do you expect there will be any reductions in cost of drilling tools and equipment?"

Fig. 4 represents contractors' ideas on this subject. Ten per cent of those who have participated expressed no opinion; 30 per cent thought that there would be small reductions; but the majority, or 60 per cent, felt that there would be no reduction in cost of equipment and tools.

Fig. 5 gives contractors' opinion on possible reductions in drilling costs as better equipment and tools become available. Fifteen per cent of those who participated in the poll did not expect any reduction; 25 per cent thought that the cost would be reduced approximately 15 per cent; 25 per cent estimated the reductions to be in the range of 25 cent cent; 25

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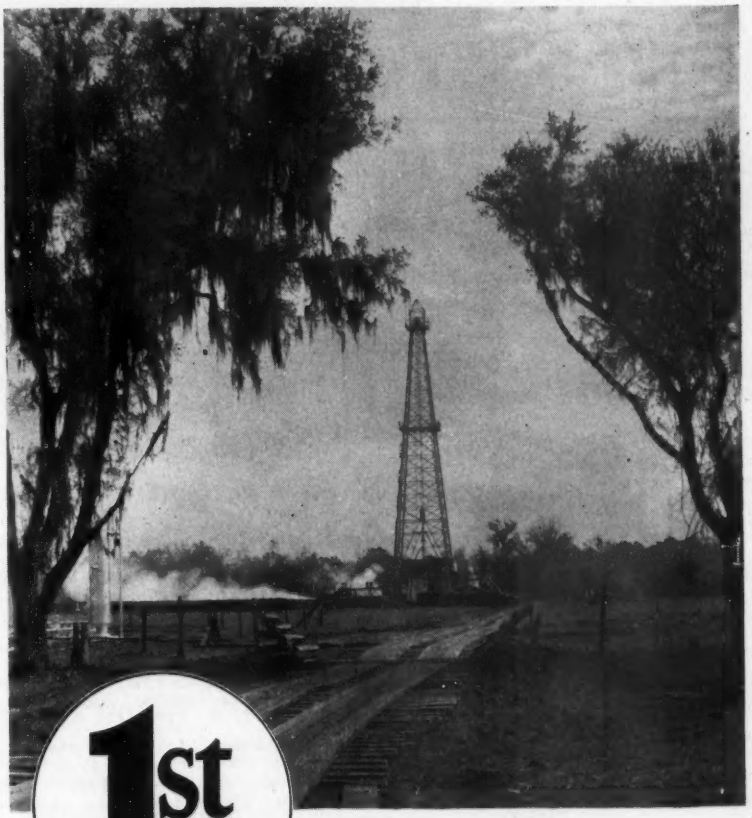

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per cent believed that 50 per cent reduction in costs is possible.

Fig. 6 gives contractors' estimates on drilling costs of 15,000-ft. wells in comparison to costs of a 10,000-ft. well. Five per cent of the participants expressed opinion that 15,000-ft. well will cost 25 per cent more than a 10,000-ft. well; 20 per cent thought that a 15,000-ft. well will cost 50 per cent more; and the majority, or 70 per cent, have estimated that it will cost 100 per cent more or twice as much as a 10,000-ft. well.

Fig. 7 represents contractors' ideas on cost of 20,000-ft. wells in comparison to 15,000-ft. wells. Here, 5 per cent of the participants thought the cost would be 50 per cent more; 20 per cent thought the cost would be 100 per cent greater; 45 per cent estimated the cost to be 150 per cent more; and 25 per cent felt that the cost will be 200 per cent more, or three times the cost of the 15,000-ft. well.

Fig. 8 represents contractors' thoughts on future costs of deep wells in the range of 10,000 to 15,000 ft. in depth. Twenty-five per cent of contractors felt that the cost will be maintained at the present level; 30 per cent believed that the cost will increase approximately 25 per cent; and 45 per cent anticipate the cost to decrease from 10 to 25 per cent.

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Fig. 9 gives a summary of ideas in regard to improvements in drilling equipment and techniques. Contractors' ideas on this subject were divided, with 50 per cent of participants expressing an opinion that there would be only slight improvements while the other half thought that improvements would be of major character.

Fig. 10 is a summary of opinion on the type of major improvements needed to make drilling equipment more suitable to drill deep wells more economically. Most of the contractors, or 55 per cent, thought that better and heavier equipment of present design will solve most of the drilling problems; on the other hand the rest felt that radically new equipment will be needed if deep wells are to be drilled at lower cost.

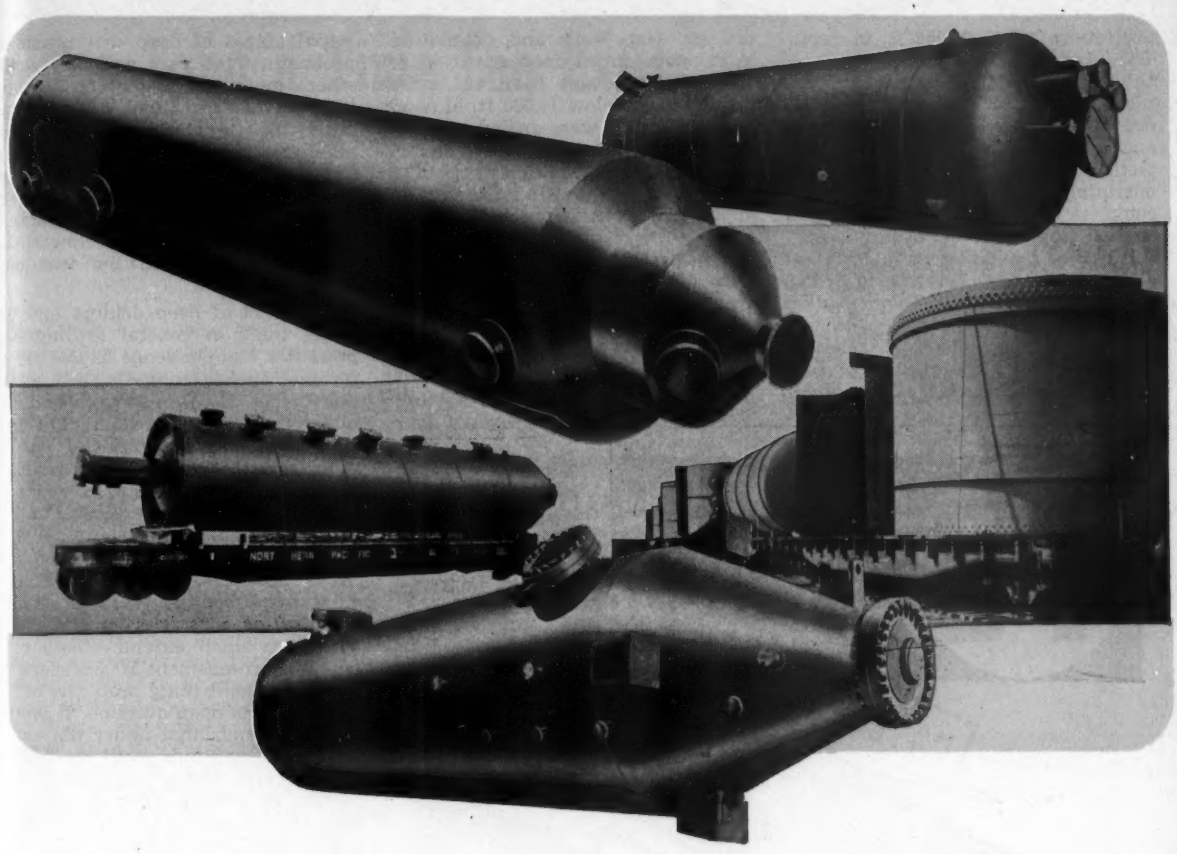
Fig. 11 is a summary on the following question: "Do you feel that new drilling method or technique must be developed to drill deep wells more economically?" Majority of the contractors, or 75 per cent, thought that there is a need for a new drilling method and technique, while 25 per cent did not think that a new method is needed. Finally, contractors were asked to state their views as to ways and means by which such developments can be realized. Fig. 12 summarizes contractors' opinion as follows: majority, or 75 per cent, thought that this is a matter concerning all groups, i.e. oil companies, drilling contractors, and manufacturers; and the remaining 25 per cent had no opinion on the subject.

Depth and Costs

Studies of deep-drilling costs indicate that the cost per foot is approximately doubled when well depths are increased from 5,000 to 10,000 ft., and that the average cost per foot to drill 15,000-ft. wells would be approximately twice the cost of 10,000-ft. wells. At this ratio, a 15,000-ft. well will cost three times the cost of a 10,000-ft. well. A 20,000-ft. well will cost slightly less than three times the cost of a 15,000-ft. well.

A point of interest in connection with the contractors' poll is that the contractors are more confident that wells 15,000 ft. and deeper can be drilled with improved design of rotary equipment at costs which are considerably less than those indicated by present costs. The difference in the estimated cost is illustrated in Fig. 13. Needless to say, the estimates are very rough approximations, nevertheless, they illustrate the point. On Fig. 13 there are shown two trends, one of which is representative of days required to drill and complete a well of various depths from 6,000 to 20,000 ft.; and the other the operating cost of rig per day. From these two curves drilling cost of well to any depth can readily be calculated.

The operating days curve has two



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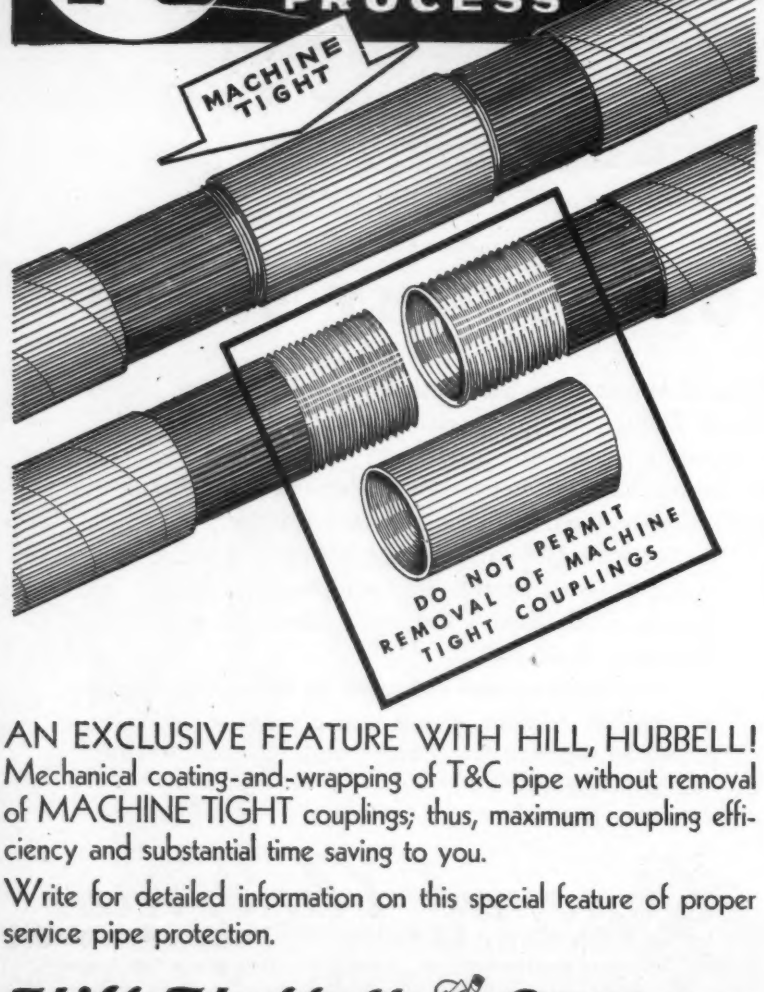
projections up to 20,000 ft. in depth. The upper projection is on basis of actual days required to drill and complete wells from 7,000 to 16,000 ft. in depth as reported in trade magazines and company reports. The lower projection, representing the number of operating days required to drill and complete various depth wells, was calculated from contractors' estimates.

It will be noted that there is a great difference in days required to drill a complete well, and consequently in drilling costs as shown by the two projections. This wide difference is an indication of confusion now prevailing in the industry as to cost of drilling deep wells and possibilities in development of deep-seated oil reserves. There have been but a few wells drilled below 15,000 ft. in depth and these wells were drilled with rigs which were not designed for drilling to such depths. Therefore, possibility exists that the trend indicated by the upper projection is not indicative of future costs of wells below 15,000 ft. in depth.

On the other hand, drilling costs as estimated by contractors are probably conservative, particularly for a near-term forecast. It would appear that actual drilling costs may be somewhere between the two lines. In the initial stages of deep drilling in all probability the cost will fall somewhere in the upper half of the area between the two lines. After the industry has been provided with suitable equipment and acquired more experience in deep drilling, the costs may approximate those represented by the projection made on contractors' estimates or at least in the lower half of the area between the two projections.

High cost of deep drilling and the rising trend in general drilling cost present a real challenge to the industry that spends annually over a billion dollars for proven area and exploratory drilling. A reduction of only 10 per cent in drilling cost should save industry millions of dollars a year, and well-organized research could result even in greater than 10 per cent saving.

Thus far in drilling research, industry has relied largely on equipment manufacturers with producers and drilling contractors participating only to a small extent. Whether or not this arrangement is sufficient to overcome the drilling problems of tomorrow is an open question. It would appear, though, that under the existing conditions funds spent on drilling research are entirely too small in proportion to drilling expenditures and that the effort lacks necessary coordination. Thus it would seem that before industry could expect a substantial progress in drilling it must devise and adapt a more suitable and effective research program.



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Gas Analyzers

(Continued from page 256)

to the amount of oxygen present in the sample flow. As a result the magnitude of the depolarizing effect governs the magnitude of the e.m.f. of the cell. Thus the more oxygen the sample flow contains the higher is the e.m.f. generated by the cell.

The carbon monoxide recorder operates by continuously drawing samples of the contaminated atmosphere into the instrument by means of a small motor-driven pump. The air sample is first passed through a metering device which maintains a constant flow. It is then passed monoxide are shown in the chart.

From the dehydrating canister the sample flow enters a cell which contains a catalyst, known as Hopcalite. From this cell the sample flow passes through the pump and out the exhaust valve. In the cell containing the Hopcalite, any carbon monoxide in the sample flow is oxidized by catalytic action. The heat liberated by this oxidation is in direct proportion to the carbon monoxide concentration in the air sample and is measured by means of a thermopile and an indicating meter or electronic recording potentiometer.

Too Long a Time Lag Exists Between Research and Practice

by F. R. Cozzens

AMAZING in number, and oftimes confusing in nature are the geological discoveries which have been made by research engineers within recent years. Many such findings are, without question, destined to play a very important part in the future recovery of oil and gas, but the multitude of technicalities, plus the nature of the publicity given them, have resulted in some very erroneous ideas relative to research effort and its immediate application to actual field practice.

To the uninitiated, it would appear that all a prospective oil producer need do is to take a core sample of his pay sand to the nearest laboratory. There, he would be told the probable amount of the recoverable oil that existed in each acre of his territory. From the porosity and permeability of the sand sample, he would learn how to shoot his wells, and what pressuring methods to apply. He would leave the laboratory, perhaps, with prescriptions and formulas to be given as directed when his wells became aged and infirm. All that remain necessary (so it appears) is to go home, put the information to work, and watch the oil flow into the tanks.

The Small Producer

The true picture, however, is that back in the locality where the sand samples came from, wells are still being punched down in much the same manner as they were 35 years ago. Since he is at heart an inventor, and has long been of necessity his own engineer, the independent producer is still experimenting, and often accomplishes a desired purpose without knowing why. It will surprise geological exponents to learn that many discoveries, accredited to laboratory research, are already in action in various inconspicuous oil and gas fields.

Take, for example, the intermittent shooting of wells with small charges of gelatin or gelamite (15 to 25 lb. at a time, with sand cleaning between blasts) which is giving much better results than single large shots in many sections of the eastern stripper fields. This is a crude application of one principle of selective shooting. Many independent operators learned years ago that by allowing salt water to encroach upon certain areas of pay sand, more oil could be produced with less pressuring. This feat comes under the heading of counterbalancing pressure. Not a few operators would be startled to learn that they created a Jamin action in a pay sand when wells were slugged (intermittent injection) with air or gas. Countless other examples could be mentioned. Suffice to say, the independent producer has always been at the front in making discoveries.

This does not mean to imply that research has not kept pace with field developments, nor is it meant to belittle laboratory practice. Far from it. Examples are cited to show that the average independent producer still follows to a great extent, the pioneer trend and takes little, if any time out to acquaint himself with research developments. Many research groups, on the other hand, are not approaching the average producer at the right angle, and this lack of cooperation

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often creates a lag or delay of months or even years in getting a measure into effective usage in the field. Such delay can easily cause serious repercussions in a territory badly depleted of oil and gas, and if the present policy is allowed to continue until flush production methods have failed, many promising properties will not be worth a secondary-recovery effort.

Earnest research groups, allied with the production of oil and gas, strive in a general way to work in close contact with field operations, and the present problem is to relay such information to the greatest number of producers in the least possible time. The major obstacle which retards the effort and encourages lag or delay is the complexity of interests, each locality having problems and difficulties of its own. This makes the solution impossible by any specific formula, but researchers could shorten the lag considerably by phrasing technicalities in common English, so the practitioner could understand a principle without need of an interpreter.

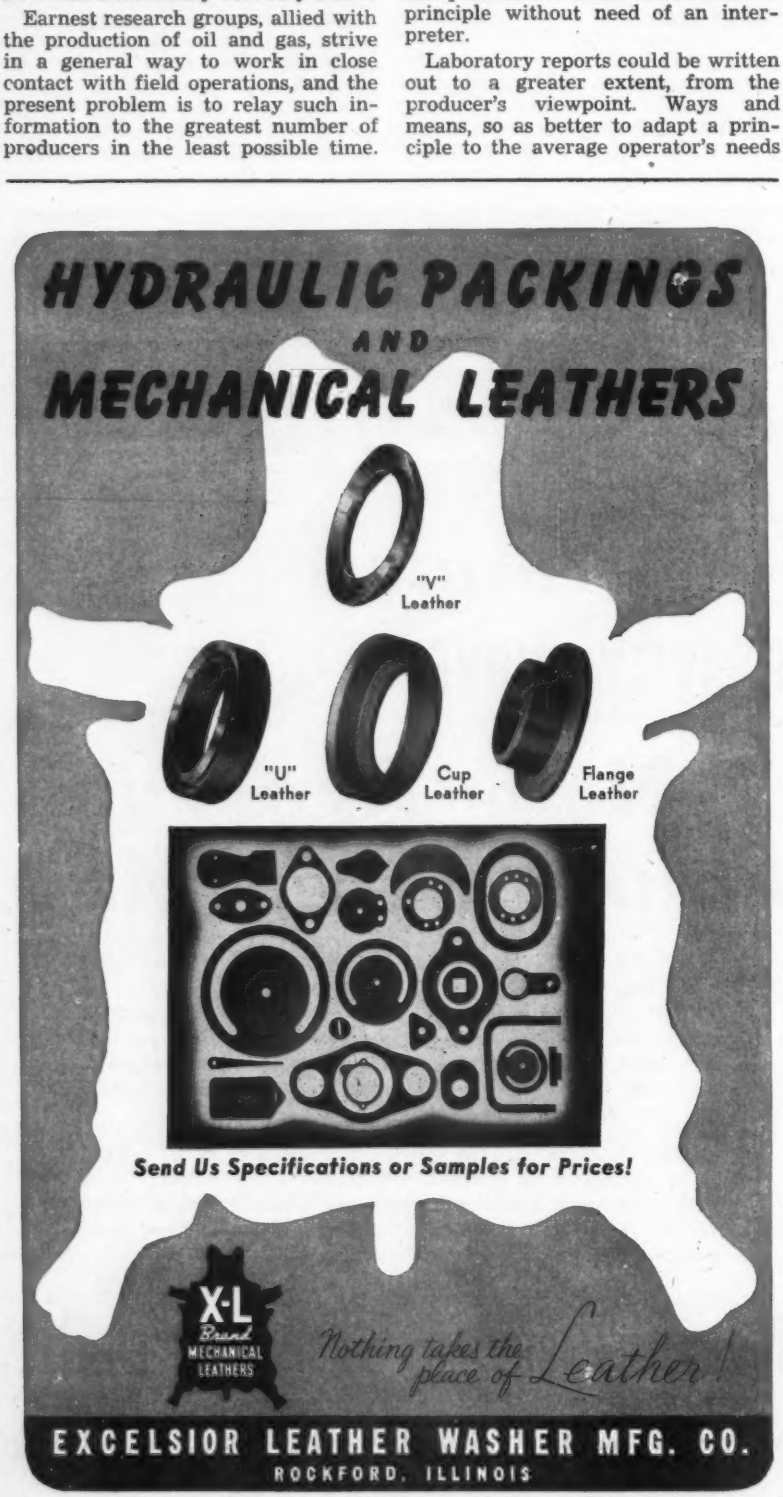
Laboratory reports could be written out to a greater extent, from the producer's viewpoint. Ways and means, so as better to adapt a principle to the average operator's needs could be formulated, and major plans scaled down so the smaller producers could use them. A very effective method of bringing such revisions about is to have on the research staff one or more actual oil and gas producers who understand the needs and limitations of the smaller projects. This would enable the average producer to better understand, at least, the whys and wherefores of what he is actually doing. This is of vital and immediate importance because many field discoveries, now proving beneficial, may have serious, and detrimental effects later on.

A principle not clearly understood is likely to get out of bounds and unmanagable; as for instance, the early attempts with air pressuring where hundreds of acres of good virgin territory were ruined, and thousands of barrels of oil wasted before sufficient knowledge was attained so as to apply the measure effectively. An oil or gas-bearing formation is a very complicated structure which must be operated according to its nature for best results, and we are likely to discover that other field-invented practices now in use are capable of bad after effects, such as the forming of oil traps, and escape of oil into formations which can not be pressured. If such is the case, every moment of knowledge delay adds materially to the cost of production.

Something About Research

Before sufficient research effort can be utilized on scores of smaller properties, the average oil producer must have a truer concept as to what is actualy meant by the term "research." He must also rid himself of the erroneous belief that production research is a commercial venture, designed only for the benefit of a certain few. This belief originated back in the divining-rod era, when many self-styled "professors" wandered up and down the land, offering conjured-up oil and gas secrets for certain specified sums.

Authorized production research is not confined to any one group, nor does it aim to benefit any one group at the exclusion of others. In reality, it is an organized investigating committee, staffed by a competent personnel, and fed through the experimental developments of many fields; principally from the geological, chemical, and engineering fields. The basic purpose is to provide honest, constructive search for useful truth. Much research work is made possible through financial endowments of pioneers who recognized the need for better understanding in a particular field, but were unable to obtain that knowledge for themselves. Practically all authoritative research work is now carried on by men who have spent years of conscientious effort in securing text-book and laboratory knowledge necessary to their calling. Resources of this nature, drawn from



varied fields, provide a veritable storehouse of constructive information for any practitioner who taps it.

Much experimental work, relative to research, must of necessity be carried out on major projects where equipment and facilities are adequate and available. This does not mean that the big companies are being favored at the cost of the small independent. The purpose of selection is to provide an efficient proving ground so as to distribute information beneficial to all. The producer's duty and privilege is to obtain his rightful share of this, and in more than 80 per cent of the cases he can accomplish the purpose through systematic cooperation.

As exemplified in various districts of the eastern stripper fields and elsewhere, research help is most readily available to a unitized project, where a dozen or so small properties are operated through mutual effort. On such projects, laboratory analysis of pay sand can be made of all the leases at very nominal cost to each producer. Selective shooting technique can be demonstrated in much the same manner, perhaps on marginal wells. Modern engineering principles (many of them) likewise can be carried out on unitized projects, and the prestige of group action often induces local supply house and manufacturers to lend or volunteer the use of equipment and materials necessary in making tests.

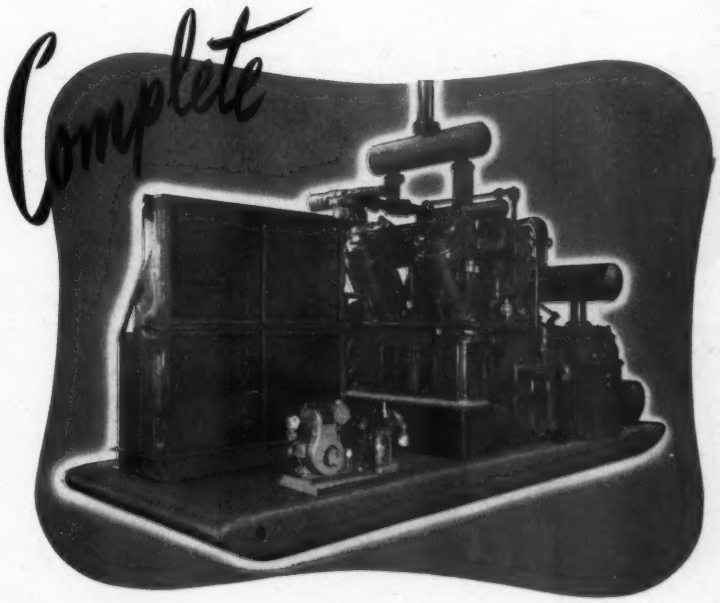
Cooperative Research

The big majority of properties, of course, are not unitized but it is still possible to obtain considerable research assistance through cooperative action. A dozen or more producers can often bring this about by arranging (somewhere in the locality) an open-forum meeting, to which a representative of a research staff is invited. The local offices of most research groups are usually anxious to learn of get togethers of this kind, and are quite willing to attend and assist with production problems associated with that locality.

The primary purpose of such meetings is to devise ways and means of getting specified problems solved. It often happens that by each producer chipping in a little dry hole money a test or demonstration can be conducted, preferably on some typical, centrally located property. Sometimes, an interested producer will volunteer the temporary use of his lease as a testing ground. Quite often, the research representative will take the initiative, and sponser a test or demonstration, to which all producers and property owners within a certain radius are invited. Especially is this likely if the problem concerns secondary-recovery measures. One or two such meetings generaly enable producers and a research staff to form a workable outline as to the type of assistance required, and considerable lag or delay is eliminated in getting a recovery measure under headway.

Producers should also make it a rule whenever possible, to attend various meetings of their oil and gas associations since some type of research is generally a topic for discussion. In these, and divers other ways which develop through closer contact, producers and research groups become better acquainted. Existing field practices are made more clear and concise because greater effort will be put forth to understand them. Such understanding is immediately necessary because, as flush production wanes, oil-recovery complications and difficulties increase, and hundreds of smaller properties must soon be abandoned unless more research aid is available. The need is greatest among the smaller independents who can least afford to lose out.

By working together, instead of following separate courses towards the same goal, research groups and producers can reach an objective in much less time and with substantial savings in effort and expense. The present production picture proves that laboratory analysis is just as important as field practice. One can not operate beneficially without the other, and both are vitally necessary in the future recovery of oil and gas.



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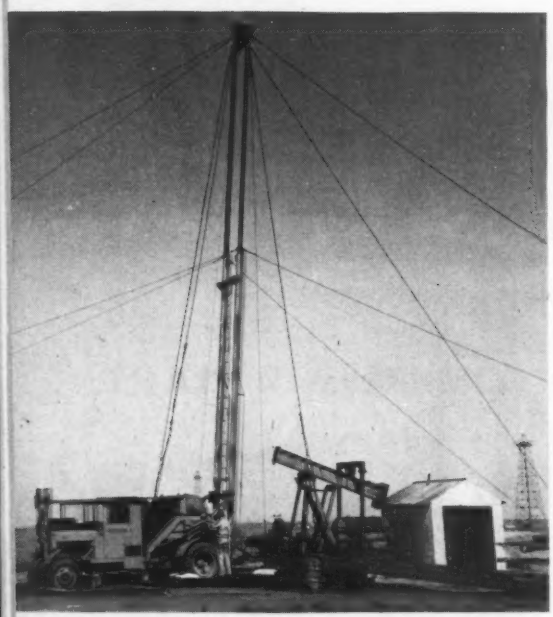

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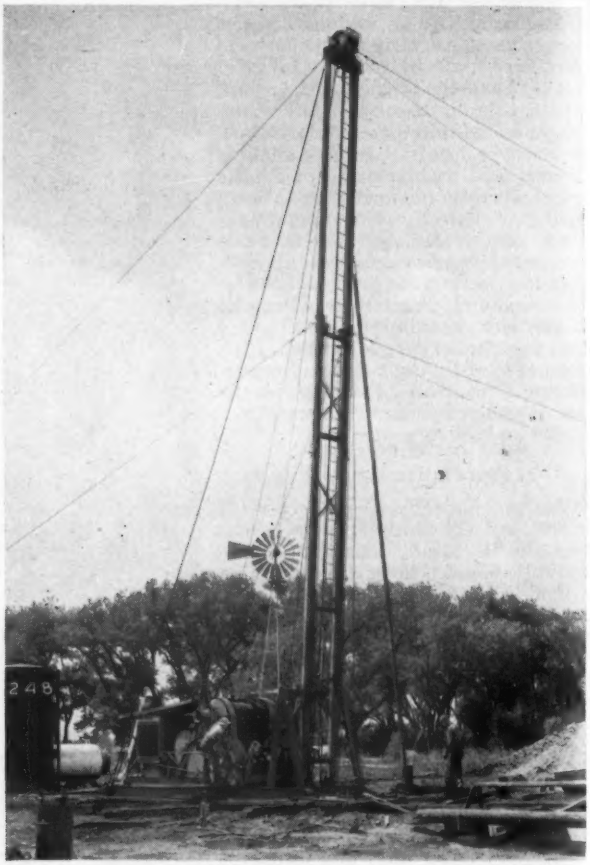


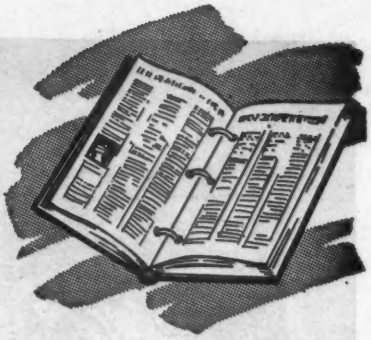
Model R double drum hoist with spudder and 65-foot telescoping drilling mast. Complete rig is capable of drilling to 7,500 feet with cable tools. When Model R is equipped with rotary assembly, the same mast may be used for rotary drilling to 5,000 feet, or workover jobs to 6,000.

CONDENSED SPECIFICATIONS

Model	*Type of Mast*	*Available For Model*	*Load Safety Factor 2*	*Groove Sheave Dia.*	*Telescoped Length*	*Net Weight*
OLKBM	48-foot single leg servicing mast with cross sheaves and catline block as illustrated.	Q. H. K. Mobilhoist	38,600	16"	29'-3"	2,700
OLKJM	48-foot single leg servicing mast with three sheaves in line and catline block.	Q. H. K. Mobilhoist	72,500	16"	27'-8"	2,700
OLMJM	55-foot single leg servicing mast with three sheaves in line and catline block.	Q. H. K. Mobilhoist	58,750	16"	31'-2"	2,900
TLMJM	55-foot double leg servicing mast, three-sheave crown and catline block.	H. K. S. Mobilhoist	79,500	16"	33'-8"	5,100
TLDPM	65-foot double leg drilling mast, four-sheave crown.	H. K. R. S	128,000	20"	38'-2"	7,200

The Refiner's Notebook

A WEEKLY FEATURE OF THE OIL AND GAS JOURNAL



Suggestions on Pump Selection

ALTHOUGH reciprocating, centrifugal, and rotary pumps are used in petroleum refining, each type has characteristics that are valuable and others that tend to limit its usefulness. Reciprocating-pump mechanisms operate by taking a charge of liquid into a cylinder through one set of check valves and discharging it by the action of a piston (or plunger) through another set of valves. Such a machine is vitally dependent on the valve action and upon suspended solid matter that may unseat the valves or score the cylinder walls. They are admirably suited for low capacities, high heads, and for the handling at low speeds of viscous fluids. **Centrifugal** pumps act by imparting velocity to the fluid by means of a revolving impeller which throws the liquid outward and into a discharge line. They are admirably suited for low heads and large volumes. They must be operated within a reasonable range of capacity and provision must be made for a flooded suction. **Rotary** pumps are of many designs but most of them involve a revolving mechanism which catches a portion of fluid in a moving pocket and delivers the liquid to the discharge connection.

The following tabulation and brief discussion perforce emphasizes only the general characteristics and most widely accepted conceptions. There are many exceptions.

Head and Capacity

Reciprocating pumps—High head, low capacity.

Centrifugal pumps — Low head, high capacity.

Rotary pumps are usually low-capacity, low-head designs although some operate at high pressures. The capacity cannot be varied much except by varying the speed.

Displacement characteristics. — Reciprocating and rotary pumps are **positive-displacement** pumps. This means that the full power input will be developed in the discharge liquid (except for "slip") if the discharge line or valve is closed. This may burst pump-valve boxes "blow" gaskets, or cause rupture and spilling of hot oil. Relief valves from discharge to suction must be provided. "Pinching" off the discharge of a **centrifugal pump** only slightly increases the pressure. Thus, centrifugal pumps are admirably suited for instrument controls that operate by throttling of the discharge valve.

Costs. — Centrifugal pumps are usually cheapest although for very low capacities the rotary pump is cheapest.

For low capacities and high pressures the reciprocating pump probably operates most cheaply whereas for large capacities and low heads, the centrifugal is best. Approximate costs of operation (exclusive of labor and fixed charges) can be estimated from the chart of Refiner's Notebood No. 145 (June 7, 1947, page 103). Reciprocating pumps wear and the replacements are expensive. Replacements for centrifugal and rotary pumps are usually inexpensive.

Type of fluid.—Centrifugals best handle nonviscous fluids such as water or light oils but proper suction connections permit the handling of viscous or volatile fluids. **Reciprocating pumps** handle any materials. Special close-clearance valves and slow speeds enable reciprocating pumps to excel for vacuum or volatile services such as the pumping of liquids at their boiling point. Lubricants or semi-solids such as tar, grease, soap, glue, etc., are the best for **rotary pumps** although all materials have been handled. Minor amounts of abrasive agents in the liquid are best handled with centrifugal pumps but large amounts of abrasives are sometimes handled by rotary pumps because replacements are cheap or with end-packed plunger pumps because the packing easily can be tightened or replaced.

Operating characteristics. — Reciprocating pumps can be regulated to cover a wide range of capacity or head. The same is true of rotary pumps except that expensive speed-reducing gears must be provided and the volumetric efficiency is poor at high speeds. The head-capacity relationship of a centrifugal pump is fixed (see Refiner's Notebook No. 136, March 22, 1947; No. 142, May 3, 1947; No. 149, entitled "Centrifugal Pump Curves," June 21, 1947; and No. 150 "Affinity Laws," June 28, 1947) unless several impeller sizes are available or the speed is regulated by means of a steam turbine. Rotary pumps should be used for a single capacity and little adjustment is possible.

Centrifugal pumps must be primed each time they are started.

In most plants the workmen understand reciprocating pumps and may not understand the suction requirements, priming, shaft alignment, etc., of centrifugal pumps.

Reciprocating (and rotary) pumps maintain a substantially constant capacity regardless of variations in discharge and suction pressures.

Flow characteristics.—The **pulsating** flow produced by reciprocating pumps and to a minor extent by rotary pumps may cause severe stresses and vibrations in the piping system, damage delicate instruments, cause screens or filters to plug, and cause oil burners to "breathe." Air or gas chambers in the line are seldom satisfactory because the gas is rapidly dissolved and removed from the surge chamber.

Suction. — The positive-displacement (reciprocating or rotary) pumps can produce the largest suction lift (maximum about 25 ft.). Slow speeds are helpful. Some centrifugal pumps can produce a lift of 15 ft. (self-priming pumps even more) but many engineers feel that **all** centrifugals should have a flooded suction.

APPROXIMATE MAXIMUM LIFT OF PUMPS WHEN HANDLING WATER AT VARIOUS TEMPERATURES

	Lift or head		
	60° F.	140° F.	210° F.
Centrifugal	15	5	12 ft.
Reciprocating and rotary	22	7	12 ft.
Self-priming centrifugal	27	21	..
Theoretical	33	27	1.0

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MODERN Rotary DRILLING

Methods of Evaluating Service Expectancy of Wire Lines

UNDER conditions of present-day drilling the need for determining the service of wire rope is even more urgent than it was in the past. Only by consideration of comparative service data is it possible to determine the efficiency of any given line and of the measures taken to prolong the line's useful life. Knowledge of this efficiency is of particular importance in view of the size of loads now handled by rotary-drilling lines and of costs of lines and rig time used in changing of lines.

An accepted standard of evaluation of the service of wire lines is the work performed by the line as expressed in ton miles. The following considerations are a summary of recommendations of the A.P.I. committee on wire rope and manila cordage as shown in A.P.I. Standards No. 9-A, Eleventh Edition, October 1944.

Total Service

Total service performed by a rotary-drilling line consists of the sum of ton miles of work performed by the line in round trips, drilling, coring, and setting of casing.

The formula recommended for calculation of the work performed by the line during a round trip is the modified Anderson formula. The formula, assumptions on which it is based, and the modifications of the original formula are given in the above-mentioned A.P.I. standards. An alignment chart constructed from this formula is shown in Fig. 31.

In the chart the curved lines represent the factor M + 0.5C, where:

M = total weight of block, hook, links, and elevators, lb.

C = excess drill-collar weight with allowance for buoyancy

Value of C may be found from equation:

$$C = (L \times C_m) - (L \times W_m)$$

where:

L = length of drill-collar assembly, ft.

C_m = weight per foot of drill collar in mud [equal to $C_a (1 - 0.002B)$]

C_a = weight per foot of drill collar in air, lb.

W_m = weight per foot of drill pipe in mud [equal to $W_a (1 - 0.002B)$]

W_a = weight in air of drill pipe, lb.

B = weight of rotary mud, lb. per cu. ft.

Letters in the right-hand scale of the chart indicate the weights of various sizes of drill pipe, corrected for weight due to tool joints and for effect of buoyancy, in mud weighing 75 lb. per cu. ft. Key to these letters is:

	Drill pipe Size (in.)	Drill pipe Weight (lb.)
A	2 3/8	6.6
B	2 7/8	8.3
C	2 7/8	10.4
D	3 1/2	13.3
E	3 1/2	15.5
F	4 1/2	16.6
G	4 1/2	18.1
H	5 9/16	22.2
I	6 5/8	25.2
J	8 5/8	46.5

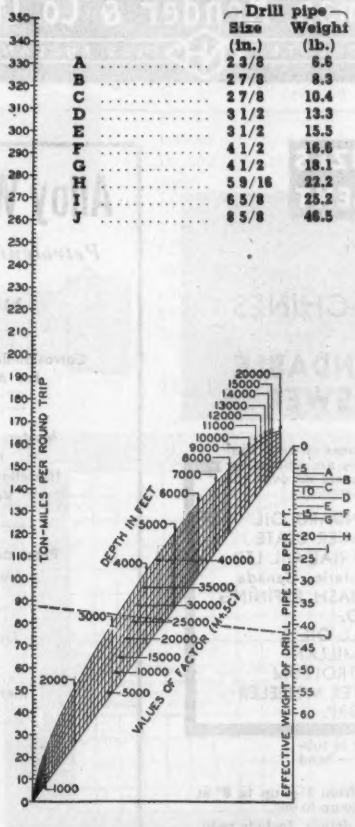

Fig. 31—Rotary drilling-line ton-mile chart (From A.P.I. Standards No. 9-A, Eleventh Edition, October 1944)

The following example illustrates the use of the chart. Assume: Weight of pipe, 42 lb. per ft. Depth, 4,000 ft. Factor (M + 0.5C), 15,000 lb. To solve: Find the intersection of the vertical line corresponding to the 4,000-ft. depth with the curved line corresponding to 15,000. Connect this point with the drill-pipe weight of 42 lb. on the right vertical scale. By prolonging this line to the left scale, the ton miles per round trip is found to be 88.

Drilling Ton Miles

The sum of drilling ton miles may be calculated from the relationship between the drilling and the round-trip ton miles. This relationship may be arrived at from the study of the sequence of hoisting operations which take place between drilling down of successive stands of the string. These operations include drilling, reaming, pulling up twice, putting kelly in the rathole and picking the kelly up, and picking up singles or doubles of the drill pipe. When these cycles are totaled for any one hole they equal three full round trips to bottom. Thus the drilling ton miles may be calculated from the round-trip ton-mile chart.

Coring Ton Miles

When a large amount of coring is done, the coring ton miles may be figured by taking two times the difference in ton miles per round trip at the end point of coring and the ton miles per round trip at the beginning point of coring.

Casing Ton Miles

Ton miles work performed by the rope during setting of casing may be calculated by taking one-half ton miles for round trip with corresponding weight of drill pipe.

Service Record

Calculation of ton-mile service of a rope requires the keeping of daily records of operations including data needed for use of the chart, such as depth and number of round trips; size, weight, and range of drill pipe; mud weight, and weight of the traveling-block assembly.

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ENGINEERING *fundamentals*

Basic Physical Tests for Steels

THERE are many different kinds of physical tests applied to steel. A few of the more important and widely used will be discussed and some of the others mentioned.

Tensile tests are the most common and valuable tests for most purposes. Fig. 1 shows an A.S.T.M. standard test bar before and after breaking. The bar is placed in the testing machine and stretched by applying a pull in the direction of the long axis until the bar pulls apart. Each time additional load is put on the machine, the unit stress (usually expressed in pounds per square inch, or total load in pounds divided by the original cross-sectional area of the specimen) and unit strain (usually expressed as inches of stretch per inch of length) are measured and recorded. From the results obtained on the test, a stress-strain diagram such as is shown in Fig. 2 may be drawn. From this diagram the elastic limit, yield point, and ultimate strength may be determined, at least approximately.

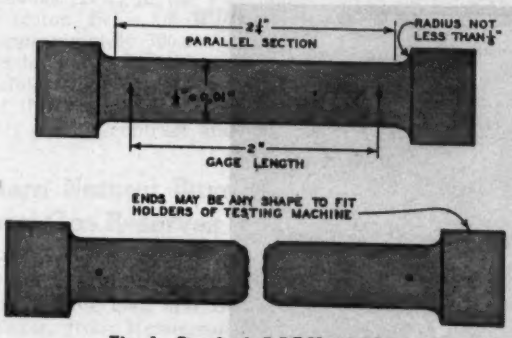

Fig. 1—Standard A.S.T.M. test bar

The following terms are those most often used in describing the results of tensile tests.

Elastic limit.—This is the maximum load, usually expressed in pounds per square inch, which, after release, will not have caused a permanent deformation or stretch in the material. For most materials, it is very difficult to determine accurately, and hence is seldom specified.

Proportional elastic limit.—This is the loading at which stretch ceases to be proportional to the load applied. Its value usually agrees very closely with the elastic limit.

Young's modulus, or modulus of elasticity.—This expression is the ratio, expressed in pounds per square inch, of the unit load to its corresponding unit stretch, below the elastic limit. For instance, for most steels, the modulus of elasticity is 30,000,000 psi. This means that a load of 30,000 psi. will stretch steel 1 in. per 1,000 in. or 1 ft. per 1,000 ft., etc., because 30,00 ÷0.001 = 30,000,000. It is of passing interest to note that, if the elastic laws held true for a great enough range, the modulus of elasticity would be the load required to stretch a bar to twice its original length.

Yield point.—This is the load, expressed in pounds per square inch, at which there occurs a definite increase in stretch without any additional increase in load. Its exact value is often difficult to determine, and, to avoid confusion, it is customary to specify what is called the **yield strength**, which is the load at which some arbitrary increase in stretch is noted. For tubular goods, the A.P.I. has defined yield strength as the load, in pounds per square inch, which will produce an increase, under load, of 0.5 per cent in the gage length of the specimen.

Ultimate strength.—This is the load, in pounds per square inch, which causes the material to break. For tension tests, the term tensile strength is more common. It is probably the most important property of a material from a physical standpoint.

Elongation.—This term is a measure of the ability of the material to stretch before breaking. It is the difference in gage length before loading and after breaking, expressed as a percentage of the original gage length. When considering this property of the material, it is important to note the original gage length, because the per cent elongation is greatest for short pieces. Since the total elongation consists of both the general uniform stretch throughout the whole length of the specimen, plus the localized exaggerated stretch in the necked-down portion adjacent to the break, it is obvious that in short pieces the necked-down portion contributes disproportionately to the total stretch. Standard gage lengths are 2 and 8 in.

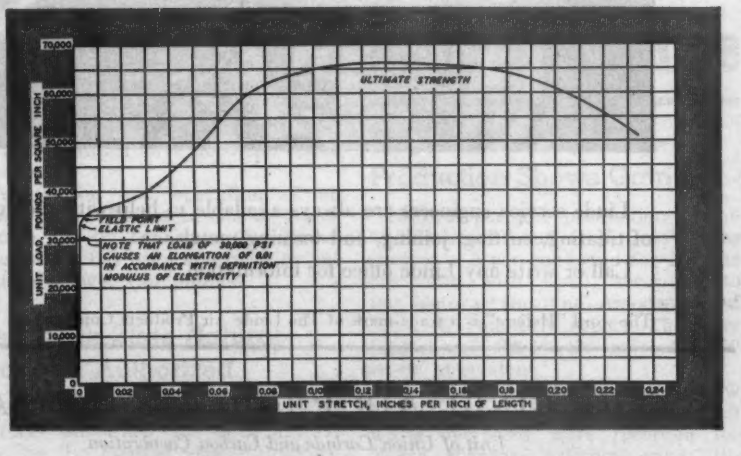

Fig. 2—Stress-strain curve for medium steel

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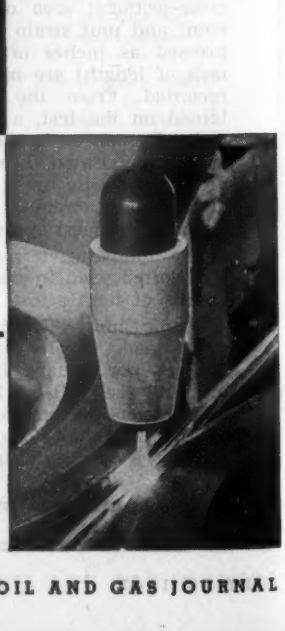

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NATURAL GAS

Adequate Reserves Seen for California Gas Line

MORE than adequate gas reserves are available to keep the Texas-California pipe line operating at its full capacity for 30 years, Paul Kayser, president of El Paso Natural Gas Co., declared at a recent Los Angeles press conference.

The 1,204-mile line, which is now under construction, will have a capacity of 305,000,000 cu. ft. per day upon completion. Kayser said that "there is now available for purchase approximately 200,000,000 cu. ft. per day in excess of the requirements of 305,000,000 cu. ft. per day for the California line."

Elaborating upon the vast reserves available, Kayser made this statement, "We have contracted to purchase for a period of 30 years, 180,000,000 cu. ft. per day to be delivered at one point near Dumas, Tex., in the Panhandle and Hugoton fields of West Texas from approximately 300,000 acres estimated to contain in excess of 5 trillion cubiic feet of gas. A substantial part of this acreage is dedicated exclusively to this contract and, in the opinion of competent geologists, the reserves are sufficient to assure the delivery of the 180,000,000 cu. ft. per day for the full term of the contract. We have likewise entered into various other contracts supported by adequate reserves for the entire requirements of the line.

"Last month we merged Western Gas Co. (the producing subsidiary of El Paso Natural Gas Co.), with a company owning substantial reserves in South Texas and did the financing necessary to give the new company substantial working capital for exploration and development work. The new company has acquired a half interest in approximately 300,000 acres of leases in the San Juan basin in northwestern New Mexico, southwestern Colorado and southeastern Utah and has contracted to drill four wells in this area. Substantial gas reserves have already been developed in this area and the structures to be drilled should uncover substantial additional reserves, all of which logically should flow to the California market."

Western Natural Buys Natural-Gas Reserves

Purchase of 8,000 acres of producing leases and 16,000 acres of wildcat acreage in Live Oak and Bee counties, Texas, from Henderson Coquat has been announced by Western Natural Gas Co. Consideration was $1,750,000 cash and $1,750,000 to be paid from products and property sales.

Paul Kayser, president, said the purchase was made to increase the company's natural-gas reserves. A small recycling plant will be installed immediately, he said. Western Gas Co. was merged with Gulf States Oil Co. in May and the name changed to Western Natural Gas Co.

Texas Eastern to Make Shreveport Headquarters

Principal operating offices of Texas Eastern Transmission Corp. will be located in Shreveport beginning in August, R. H. Hargrove, president, has announced. About 25 employes will be transferred from Cincinnati to Shreveport in making the change.

At present, the company also has offices in Houston and New York.

Stockholders Approve Changes of Tennessee Gas

Proposals to change the name of Tennessee Gas & Transmission Co. to Tennessee Gas Transmission Co. and to change the state of incorporation from Tennessee to Delaware have been approved by the company's stockholders.

Gardiner Symonds, president, said he had recommended the incorporation change because of uncertainty of Tennessee statutes applying to pipe-line corporations and the fact that the statutes have not been tested in courts.

Acquisition and operation of all properties of Tennessee Gas & Transmission Co. by Tennessee Gas Transmission Co. has been approved by the Federal Power Commission.

New York State Natural Program Authorized

WASHINGTON.—New York State Natural Gas Corp. has been authorized by the Federal Power Commission to construct during 1947 and 1948 facilities to increase the capacity of its transmission and storage systems to take additional gas from the Big Inch lines and from Hope Natural Gas Co.

The facilities were authorized to provide sufficient capacity for the company to meet anticipated requirements of its customers in Pennsylvania and New York. Over-all capital cost is estimated at $5,342,366.

Construction to be completed by December 1, 1947, in Pennsylvania includes a continuous 90-mile loop line to parallel existing lines extending from a point in Armstrong County to a point in McKean County. This line would consist of 35 miles of 12¾-in. and 55 miles of 14-in. Also to be completed by December 1 is the installation of three 300-hp. and three 600-hp. compressors at the Boom compressor station in Tioga County. This construction was proposed to enable New York State Natural to take 90,000,000 cu. ft. of gas daily from the Inch lines and Hope Natural.

Other facilities, to be completed and placed in operation by December 1, 1948, are intended to enable New York State Natural to take deliveries of 110,000,000 cu. ft. daily from the Inch lines and Hope. The second group of facilities authorized includes construction of a continuation of the looping begun in 1947 and would consist of 24.5 miles of 16-in. extending to a point in Westmoreland County and 21 miles of 14-in. extending northward to a point in McKean County. Also to be constructed were 13.4 miles of 16-in. to connect the north end of an existing line in Potter County with the south end of a line in Potter County.

New York State Natural also filed with the commission an application to furnish an additional 3,000,000 cu. ft. annually to Penn-York Natural Gas Corp. for delivery to Dominion Natural Gas Co., Ltd., for distribution to markets in Ontario.

Natural Gasoline

May Natural Gasoline Production Shows Gain

Natural gasoline production in the Mid-Continent and Gulf Coast areas showed a 5 per cent gain for May as compared with April, according to the Natural Gasoline Association of America's monthly report. The May figure was 152,942,420 gal. of 26-70 or its equivalent.

Oklahoma, Louisiana, and New Mexico production in May was up while decreases were recorded for Texas, Kansas, Arkansas, and Illinois. A substantial increase was shown in Oklahoma where production jumped from 654,120 to 861,149 gal.

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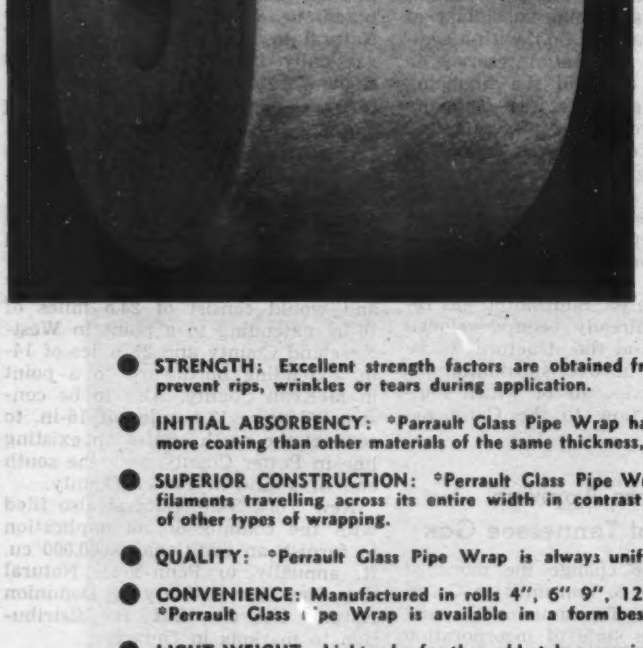

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PIPE LINES

Stanolind Prepares to Lay 260-Mile New Loop Lines

STANOLIND PIPE LINE CO. has issued specifications for the construction of loops between La Plata, Mo., and Manhattan, Ill. Bids are to be submitted by July 31.

The project will consist of a total of 260 miles, including 70 miles of 22-in. at the northeastern end of the project, and 190 miles of 20-in. along the remainder of the route. The project is to be bid in four sections; three of these are to be started soon after August 1; the fourth, which will involve the laying of 20-in., will not be started until October 1. Approximately half of the pipe has been delivered to points along the right-of-way.

For the Caprock, N. M.-Slaughter, Tex., 69-mile, 8-in. line, a total of 33½ miles had been laid at the end of last week for Stanolind Pipe Line Co. The contractor, Smith Contracting Co., was laying at the rate of approximately 2 miles a day last week.

Wyco Pipe Line Co., for which Stanolind is handling construction engineering, laid a total of 105 miles at the end of last week. Allred-Enix Co. and Pacific Engineering & Construction Co. are contractors for this 268-mile 8-in. products system.

McVean & Roberts are moving equipment to the job of laying 17 miles of 16-in. to replace 8-in. between Freeman, Mo., and Standard Oil Co. (Ind.) refinery at Sugar Creek, Mo. The present Freeman - Sugar Creek 8-in. line is 35 miles long. As a result of the project, the capacity will be increased from 28,000 to 45,000 bbl. daily. The 20-in. looping program between Drumright, Okla., and Freeman, Mo., has been completed.

Stanolind to Construct 51-Mile Garza County Line

Construction of 51 miles of 6-in. from Post pool, Garza County, Texas, to a point near Petersburg is planned by Stanolind Pipe Line Co. The line is expected to be completed by December 31 and joins the company's 16-in. trunk line from Sundown to Drumright, Okla.

Upon completion of the line, Stanolind has arranged to buy the gathering system in the Post area which is jointly owned by Scurlock Oil Co. and Wood River Oil Refining Co. The price for this purchase has not yet been negotiated.

Work Progresses on Chicago Line

In the construction of 70 miles of 26-in. in southeastern Nebraska and across the boundary into Kansas, 12 miles had been laid early this week for Natural Gas Pipeline Company of America's Chicago line.

The job is contracted by J. R. Horrigan Construction Co., Oscar E. Dempsey, and Joe Dempsey as a joint venture for this project. This loop connects with a 105-mile, 26-in. loop laid for the Chicago line in 1941.

Three Spreads at Work on Mississippi River Fuel Loops

In the expansion of its trunk system, Mississippi River Fuel Corp. is laying 22-in. loops, for the construction of which there are now three spreads in the field. Two of these are Holland Construction Co. spreads working in Arkansas. Potashnick & Allred have a spread in Missouri; this contractor is expected to put another spread in Illinois when arrangements are completed.

Looping is being pushed by Mississippi River Fuel Corp. as fast as the available supply of pipe permits.

Arizona 26-In. Line Nearly Half Completed

In the laying of 235 miles of 26-in. pipe across the State of Arizona for El Paso Natural Gas Co., the contractor, Midwestern Contractors, Inc., and S.W.D. Co., had laid 115 miles at the beginning of this week. M. T. Wilhite is superintendent. Other work of this contractor is as follows:

Operations are starting for the construction of terminal stations for Wyco Pipe Line Co. at Cheyenne, Wyo., and Denver, which will be completed November 15.

Work on 43 miles of 16-in. for Ohio Fuel Gas Co. is nearly completed. At the beginning of this week, only 4 miles near Granville remained to be laid. Around August 1, work will start on 77,000 ft. of 20-in. near Shelby, Ohio. B. L. Weller is to be in charge of this work.

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Midwestern is starting construction of approximately 170 miles of gathering lines ranging from 4 to 20-in. Carl Stanley is the superintendent in charge of laying of the 12, 16, and 20-in.; he has headquarters at Garden City, Kans. The smaller-size pipe has been subcontracted to William Morrison with an office at Garden City.

At Stinnett, Tex., the installation of Engine 9 has been completed for Texoma Natural Gas Co., and the unit is now in operation. A supplemental contract has been negotiated by Midwestern for work which has just started for the installation of nine units at this station under the supervision of J. A. Bard, superintendent. Work will be completed in approximately 8 months.

Chicago District Lease Proposal Approved

WASHINGTON.—The Federal Power Commission has granted authority to Chicago District Pipeline Co. to acquire by lease and to operate extensions of its Crawford and Calumet lines and specified connecting laterals now owned and operated by Peoples Gas Light & Coke Co. Facilities to be leased include a 20 and a 24-in. pipe line extending from the terminus of Chicago District's Crawford line at the western city limits of Chicago to the intake of its metering station on the Crawford plant site of Peoples company and a 24-in. line extending from the terminus of Chicago District's Calumet line at the southern city limits of Chicago to and into the Calumet Station of Peoples company.

Mahoney Starts Work On 9-Mile Michigan Line

Construction has been started by Mahoney Construction Co., Mount Pleasant, Mich., on 9 miles of 6-in. gas pipe line for Sohio Petroleum Co. The new line will join Garfield-Orient Stray gas field with Sohio's line from Coldwater field to Dow Chemical Co., Midland.

Work is expected to be completed by August 1. Mahoney will also lay a 3 and 4-in. gathering system to Sohio's gas wells in the field.

United Natural Installs FM Radio Facilities

United Natural Gas Co., Oil City, has installed a frequency modulation radio station to maintain contact with its widely scattered substations.

Fixed transmitters are located at five of the company's substations in northwestern Pennsylvania, and two-way radio sets are being installed in automobiles operated by employes.

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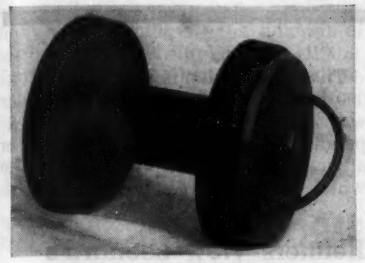

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Highland Oil Forms Pipe-Line Subsidiary

Frio Pipe Line Co. has been formed as a wholly owned subsidiary of Highland Oil Co. to transport gas from properties being developed in Frio County, Texas, to a junction point in Zavalla County, where the gas will be turned over to Texas Gas Utilities Co.

The new pipe-line company now has under construction a 50-mile, 6-in. line extending westward from Pearsall pool, to cost about $500,000. Contract with Texas Gas Utilities Co. calls for delivery of about 2 billion cubic feet of natural gas a year.

Officers of the new company are: V. A. Brill, president; Herman and George Brown, vice presidents; Herbert Frensley, secretary; J. T. Dukc, treasurer; and A. M. Cannan, assistant secretary.

Cities Service Emergency Program Authorized

WASHINGTON.—The Federal Power Commission has granted temporary authorization to Cities Service Gas Co., to construct and operate 10.5 miles of 16-in. pipe line in Grady County, Oklahoma, to be operated as an extension of a part of its southern system, and an additional 15.6 miles of 16-in. to increase system capacity on the outlet side of its Tallant, Okla., compressor station.

The facilities comprise a part of an emergency construction plan proposed by the company to build up supply on its southern system, and are an alternative to its proposed supply line to Hugoton field which was determined unfeasible by the company since it was unable to obtain the necessary pipe.

The company estimated the cost of the proposed facilities at $609,432.

Scurlock Starts Work On 25-Mile Texas Line

Scurlock Oil Co., Houston, is starting construction on a 25-mile crude line from Jameson field, in Coke County, Texas, to Colorado City.

The line will have a capacity of 8,000 bbl. per day and will connect with railroad facilities in Colorado City. Pipe is now being unloaded for the line at Colorado City, and actual laying is expected to start soon.

Oklahoma City-Maysville Line Planned by Interstate

Interstate Oil Pipe Line Co. is preparing plans and specifications for a 50-mile extension of its system from Oklahoma City to the rapidly developing Katie-Maysville, Okla., producing area.

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REFINING

Imperial Plans Refinery To Handle Leduc Crude

IMPERIAL OIL, LTD., is planning construction of a refinery of approximately 12,000 bbl. daily capacity at Edmonton, Alta., to process crude from the important Leduc field which was discovered earlier this year.

Reports from Canada said the company will erect the refinery on a 365-acre site 3 miles east of Edmonton. It was indicated a plant may later be added for the manufacture of lubricating oils. Crude from the newly discovered field is said to have a good base for lubricants.

The Leduc discovery is considered one of the most significant finds in Canada's oil history. Imperial's plans for the manufacture of gasoline and other hydrocarbons by synthesis methods have been pushed into the background in view of the new source of crude oil.

The new refinery will be Imperial's eighth and its second in Alberta. The company now operates a 9,500-bbl. daily plant at Calgary. Largest Imperial refinery—and the largest in Canada—is that operated by Imperial at Sarnia, a 46,000 bbl. daily plant.

The Leduc 1 discovery, which blew in last February, is approximately 20 miles south of Edmonton. The area is 174 miles north of Calgary. The company is now completing the field's fifth producer with 39.3°-gravity oil indicated.

Imperial has indicated it plans to drill 21 wells in the area this year. The shortage of casing continues as the principal obstacle to the field's development, but Imperial is reported to have obtained further supplies for the operation.

The Leduc area is expected to provide some relief to the tight Canadian crude supply. The Leduc wells, it is estimated, will have a maximum efficient production rate of between 100 and 150 bbl. daily.

Frontier Expanding Cheyenne Tank Farm

Two 40,000-bbl. storage tanks are being constructed by Frontier Refining Co. in its tank farm at Cheyenne, Wyo. The tanks will be utilized for storage of gasoline during winter months and burning oils in summer.

The construction is a part of a $213,000 improvement program now under way at the Cheyenne refinery, expanded recently by the purchase of adjacent government facilities, to which Frontier received title June 1.

Refiners View Leonard's New Cracking Plant

One hundred refiners from all parts of the United States gathered July 16 in Alma, Mich., for a Western Petroleum Refiners Association meeting at which interest centered in the new catalytic cracking plant of Leonard Refineries, Inc.

The new Leonard plant in Alma has attracted considerable attention as the first of its kind to be built and operated in a refinery of relatively small capacity. It is a Houdry T.C.C. unit.

The plant has been in operation since March, processing Michigan crude. The builder was Houdry's construction subsidiary, Catalytic Construction Co. The plant processed up to 5,000 bbl. of charging stock per day.

Two papers were presented at the W.P.R.A. meeting. H. E. Chambers, Skelly Oil Co., El Dorado, Ark., discussed "Liquid Petroleum Gas;" John Pfarr, vice president in charge of manufacturing, Leonard Refineries, and George Kelso, of Houdry Process Corp., discussed "Design and Operation of the Houdry T.C.C. Catalytic Cracking Plant." Reid Brazell, president and general manager of Leonard Refineries, was chairman of the meeting which was topped off by a tour of inspection of the new plant.

Another W.P.R.A. meeting was scheduled to be held July 25 in Fort Worth to conclude a series of three industrial-relations conferences designed to explain features of the new Taft-Hartley labor law. Earlier meetings were in Wichita and Lansing, Mich.

Report Made on German Infrared Gas Analyzer

Automatic infrared gas analyzers said to detect concentrations of carbon monoxide, carbon dioxide, or hydrocyanic acid as low as one part in one hundred thousand were invented in Germany just before the war, according to a report available from the Office of Technical Services, Department of Commerce.

The report, based on interviews with leading German technicians, describes the methods and equipment used in applying infrared absorption spectroscopy to chemical analysis in Germany. I. G. Farbenindustrie manufactured about 400 of the analyzers and used most of them for analyzing flue gas, determining the amount of methane in air, ethylene in ethane, and acetylene in ethane and ethylene, and for similar purposes.

Travel, Gasoline Use at All-Time Record in 1946

MOTOR vehicles operated on highways in the United States in 1946 consumed 25,649,000,000 gal. of gasoline, as compared with a total of 24,192,000,000 gal. consumed in 1941, the previous peak year, according to figures compiled by the Public Roads Administration of the Federal Works Agency from reports of state authorities.

The 1946 total represented an increase of more than 50 per cent over 1943, when gasoline rationing and other travel restrictions caused motor fuel consumption to drop to a wartime low of 16,000,000,000 gal.

California led all states in the amount of gasoline used for highway travel last year, with New York second, Pennsylvania third, and Texas fourth.

Total mileage estimated for all types of motor vehicles last year amounted to 340,655,000,000 miles, with rural travel accounting for 170,606,000,000 miles and urban travel, 170,049,000,000 miles.

Passenger vehicles, including taxis and buses, traveled 284,509,000,000 miles; trucks, 56,146,000,000 miles. Average motor-fuel consumption per vehicle was 747 gal.

The average passenger-car owner traveled 9,942 miles during the year, purchased 665 gal. of gasoline, and obtained nearly 15 miles to the gallon.

New Construction Now Under Way at Shale Plant

A crusher building to house motor equipment and a structure for refining units and experimental reports are now under construction at the U. S. Bureau of Mines oil-shale experimental station at Rifle, Colo.

The construction of 25 to 30 housing units at the Rifle plant is also under consideration. Oil is being produced daily at the plant with part of it being sent to the bureau experimental laboratory at Laramie, Wyo.

A bill now awaiting congressional action would increase the authorization for the synthetic-fuels project of the Bureau of Mines from $30,000,000 to $60,000,000 and allow the project to extend over 8 instead of the present 5 years.

Report Describes German Oil-Production Expedients

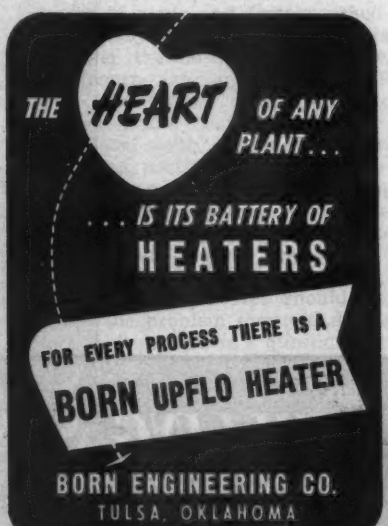
Three German oil-production processes for removing phenols from tar oil and carbonization-hydrogenation effluents are described in a report available from the Office of Technical Services, Department of Commerce.

Two German "Metasolvan" extraction plants, ready to go into production as the war ended, would have yielded 35,000 tons of diesel oil yearly, according to British investigators. The process employed methyl alcohol to extract phenols from the middle oil of brown coal low-temperature tars.

Oil produced by this method satisfactory for slow-speed diesel engines contained 2.5 per cent phenol and had a cetene number between 30 and 45. An oil containing 20 per cent phenols gave a maximum yield of 70 per cent diesel oil. The phenols contained up to 20 per cent neutral oil. Production was by atmospheric and vacuum distillation.

The "Phenosolvan" process, which uses butyl acetate to extract phenols from carbonization and hydrogenation effluents, is well established in Germany and will be used in two new plants being constructed in the Russian Zone, the report says. The effluent and solvent mixture is passed counter-currently through low-velocity separators which remove 97-99 per cent of the phenols.

An improved and simplified method of determining by direct measurement the tendency of motor oils to form sludge and varnish has been announced by The Texas Co. After extensive tests, simplifications were engineered which reduce the necessary oil charge in the original model from 250 g. to 21 g., and incorporate four units into one. Adapted from apparatus originally designed at Pennsylvania State College, the modified test makes possible a much more compact and economical unit adaptable for routine use, and particularly for research products where available material is limited, according to a company announcement. Oil in any stage from semirefined to the highly refined product can be tested more readily and accurately for its stability and varnish depositing properties



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Exploration and Drilling

Meeting the Drilling Goal

WILL the drilling branch of the industry meet the all-time-record goal that the producers have established as the objective for the last half of this year? (See page 176, this issue). If the same shortages of tubular goods should prevail that were present during the first half, this will be an idle question.

The fact, however, that this very high drilling program has been established by pooling the forecasts of hundreds of individuals and companies is significant. These individual programs have been established after 6 months of bitter experience with pipe shortages, and wide publicity about such shortages. This indicates that from one source or another, the producers are confidently counting on more pipe being available.

That puts the problem squarely in the lap of the drilling branch. Here a good running start has already been made because the number of rotary rigs running has been increasing steadily during the first half of the year. The total is now equal to and probably soon will exceed the wartime peak. (See chart on page 177). The problem is primarily one for the rotary rigs, because as indicated in the table on page 178, the producers expect to drill 26 per cent more rotary wells in the last half than they did in the first; but only 10 per cent more cable-tool wells.

There is nothing backward about the drilling branch that faces this problem. There was no after-the-war letdown in the attitude of its members toward progressive improvement. A steady stream of new ideas and improvements in design, production, and use of equipment has been moving along at a fast pace. (See page 195). That substantial results from these progressive ideas have already been achieved can be determined even by a very rough measuring stick. (See third paragraph, page 180).

No Easing Up Before Spring

Even with all this, the job ahead for the next 6 to 9 months is going to be tough. By now the fact that supplying the country's demand for refined products will be touch and go this fall and winter is known to all oil men. But some of them still do not realize that the tight situation is likely to last through March of next year, because the industry's season of peak demand is now in the fall and winter, running from the fourth quarter of one year into the first quarter of the following year. (See pages 169-171).

That makes it very likely that there will be more cold-weather drilling than in past years. If this develops, it will bring on two problems. One is winterizing more rigs for continued operation in an efficient manner during cold weather. The second problem is one of maintenance. Normally a lot of major overhauling and extensive maintenance is done on rigs that are usually idle during cold weather. With these rigs in continued operation, and under the extra strain of cold-weather drilling, this maintenance work will either have to be squeezed in somehow between jobs, or postponed at least until spring.

The labor situation will certainly not be as bad as it was during the war. But it is to be hoped that the skilled and experienced crews will not have to be diluted too much. Elimination of even one "boll-weevil" per tour after the war showed how much drag such employes put on the rest of the crew.

Wildcatting Problems

The last half of the year usually has a higher percentage of wildcats than the first half; almost invariably a higher number. These always require more time and attention than field-development wells. More logging, more drill-stem tests, more coring, more testing and checking before final completion are entailed.

Here the exploration branch of the industry must cooperate even more closely than in the past with the men who are making hole, if the latter are to drill 68 million feet during the last half of this year. Fortunately, there are more skilled geologists and petroleum engineers available than during the war. A little more planning, a little closer cooperation, a little more judgment about where coring and drill-stem testing are absolutely essential to obtain geological information will all add to less rig time over the hole. In some few cases, it wouldn't hurt the geologist to look over the terrain with an idea of judging the difficulty of getting the drilling rig and supplies in to the proposed location. Sometimes either of two locations would be just as good for a test, geologically speaking, while one would be a lot easier to move into with a rig than the other. If lease-expiration dates, contributions, and participating interests permit, the drilling rig can be moved to the location where time can be saved.

Planning Development Work

In development programs, the general trend for several years has been in the direction of planning a schedule of wells to keep each rig busy with the minimum of moving between locations. The operator who doesn't plan his program reasonably well along these lines this winter is likely to have trouble getting outside contractors if he depends on them. If he uses his own tools, he won't get as many wells drilled during the critical period, if he doesn't look over the ground and figure how to drill his wells with a minimum of moving time and trouble from one location to the next.

Service Agency Problems

All the various specialized services that are required by the drilling branch will be kept on their toes. Mud supplies, cementing jobs, various types of logging services, etc., should find their job in proportion to the number of wells and footage scheduled. Timely service cuts down rig time over the hole. However, here, too, advance planning and notice will enable the service organizations to do a better job. That will be the responsibility, partly of the drilling organizations, partly the production departments, partly the engineering and exploration departments. Teamwork in planning and advance notice will pay off in less rig time over the hole.

Repair parts for rigs should not present the problem they did during the war. But there is a question that cannot be answered until it is tested this fall. That question is whether the peacetime reconversion process has reached the point so quickly after the war that it can meet the prospective requirements indicated by such a heavy drilling schedule. Here the footage to be drilled is perhaps even more significant than the number of

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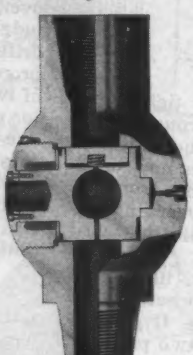

Did you ever stop to think that, even though your cellar is equipped with the most advanced safety equipment for shutting off against blow-outs around the *outside* of your drill string, you are wide open for a blow-out through the *inside* unless you're equipped with a positive *foolproof* means of closing off the top of the drill string? For this job you need the specially-engineered features of the..

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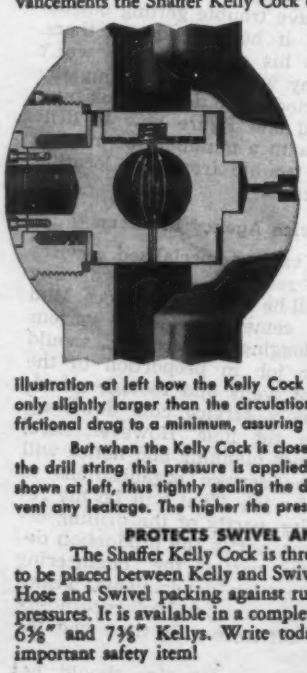

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Unlike clumsy, heavy control valves, the Shaffer Kelly Cock is compact, streamlined and balanced to prevent wobble and off-center gyration of the Kelly at even the highest rotational speeds.

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Unlike conventional types of plug valves, the Shaffer Kelly Cock is specially engineered to assure quick, easy operation at all times, *together with pressure-tight sealing efficiency.* Note in illustration at left how the Kelly Cock is designed with a "floating" disc only slightly larger than the circulation hole. This small floating disc cuts frictional drag to a minimum, assuring easy operation.

But when the Kelly Cock is closed, as well pressure increases inside the drill string this pressure is applied against the bottom of the disc as shown at left, thus tightly sealing the disc over the circulation hole to prevent any leakage. The higher the pressure the tighter the seal!

PROTECTS SWIVEL AND ROTARY HOSE

The Shaffer Kelly Cock is threaded with box up and pin down to be placed between Kelly and Swivel, thus safeguarding the Rotary Hose and Swivel packing against rupture or damage from blow-out pressures. It is available in a complete range of sizes for 3½", 4½", 6⅝" and 7⅝" Kellys. Write today for complete details on this important safety item!

...and to protect your drill string against "danger spots" at the bottom

Here's an important Shaffer safety item for the lower end of your drill string to protect against "balling up" of the bit, tight spots, heaving formations and other dangerous conditions that may stick your drill string. It's the...

SHAFFER DRILLING BUMPER SUB

And it offers a lot of important features that make it ideal for modern high speed drilling conditions. For example...

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The packing unit is not only designed to hold the highest drilling pressures, but has the added advantage that it can be quickly inspected and serviced with the Sub right in the table by simply breaking one joint and raising the upper portion a few inches.

UP OR DOWN BLOWS:

By simple manipulation of the drill string the Shaffer Drilling Bumper Sub can be made to deliver both upward and downward blows—with striking force under complete control at the surface—to loosen "balled up" bits, stuck drill pipe from key seats, etc. It is ready for operation within seconds from the time the pipe sticks—before cuttings have had a chance to settle or drill string become wedged in place.

PASSES WIRE LINE INSTRUMENTS

The Shaffer Drilling Bumper Sub is designed to be run in the drill string—directly above drill collars, reamers, or other tools that are apt to become stuck, and in all but the smallest sizes has sufficient internal diameter to permit running standard wire line tools, core barrels and similar equipment. It is available in a complete range of sizes to fit all popular drill strings. Get all the details on this valuable safeguard from your nearest Shaffer shop—or by writing direct.

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SUMMARY OF JUNE COMPLETIONS

	Comp.	Oil	Prod.	Gas	Dry	Under 1,000 ft.	1,000-2,500 ft.	2,500-5,000 ft.	5,000-10,000 ft.	Over 10,000 ft.	Total footage	Rigs and drilling
New York	157	85	201	0	[1]72	0	157	0	0	0	224,111	136
Pennsylvania	273	149	314	17	[2]107	0	0	273	0	0	415,795	234
West Virginia	74	6	138	59	9	0	42	26	6	0	190,571	239
Ohio	108	25	598	46	[3]37	8	32	67	1	0	333,583	236
Indiana	61	26	1,305	1	34	7	45	9	0	0	111,377	62
Kentucky	68	28	1,259	10	30	13	47	8	0	0	109,651	66
Illinois	163	89	11,379	2	72	8	43	112	0	0	434,072	200
Michigan	77	31	19,626	0	[4]46	1	64	12	0	0	153,256	124
Kansas	169	88	42,177	19	[5]62	1	16	152	0	0	539,283	390
Neb., Mo., Iowa	0	0	0	0	0	0	0	0	0	0	0	13
Oklahoma	392	[7]197	25,435	40	[6]155	15	152	165	56	4	1,236,976	517
Texas	753	473	99,147	39	241	30	159	298	251	15	3,435,447	1,129
North	166	97	8,272	0	69	10	83	55	18	0	525,769	231
West Central	73	34	3,405	1	38	3	25	43	2	0	210,097	74
West	178	155	61,620	2	21	13	24	75	60	6	840,677	197
Panhandle	29	18	2,157	8	3	0	4	25	0	0	92,329	151
Eastern	34	[8]18	3,068	4	12	0	3	14	15	2	192,868	110
Gulf Coast	137	[9]75	11,370	15	47	1	4	33	94	5	918,532	190
Southwest	136	76	9,235	9	51	3	16	53	62	2	655,175	176
Louisiana	112	61	9,368	8	43	5	27	32	29	19	642,416	208
Northern	62	[10]34	4,711	7	21	5	24	23	9	1	187,390	79
Southern	50	[11]27	4,657	1	22	0	3	9	20	18	455,026	129
Arkansas	24	14	4,558	1	9	0	0	14	10	0	117,855	27
Mississippi	56	[12]34	8,440	5	17	0	1	5	30	20	466,875	85
Ala., Ga., Fla.	2	0	0	0	2	0	0	1	0	1	15,291	22
Montana	34	22	1,561	9	3	2	20	12	0	0	69,844	72
Wyoming	11	[13]6	1,111	0	5	0	1	6	3	1	54,479	100
Colorado-Utah	20	12	2,940	1	7	6	1	2	11	0	82,691	78
New Mexico	46	33	21,438	4	9	2	9	18	17	0	190,905	92
California	183	144	40,116	7	32	1	43	71	53	15	847,069	261
Total June	2,783	1,523	291,111	268	992	99	859	1,283	467	75	9,651,547	4,291
Total May	2,822	1,622	286,166	269	931	113	781	1,352	493	83	9,991,558	4,455

Service wells included: [1]72, [2]102, [3]4, [4]19, [5]1, [6]7. Distillate wells: [7]5, [8]1, [9]10, [10]2, [11]3, [12]4.

wells, since it may be a better indicator of the wear and tear to be expected. From the table on page 177, it will be noted that the footage this year is programed at over 68 million feet, compared to a little under 50 million feet during the last half of 1946.

MISSISSIPPI

Jones County Test Coring in Glen Rose

JACKSON.—Gulf Refining Co. continued coring at its deep test in Jones County, the 1 L. L. Majors, 29-6n-11w, and reported top of the Glen Rose anhydrite at 12,707 ft., or —12,447 ft. Broken anhydrite, black shale and dense gray limestone were recovered from 12,707-709 ft., and anhydrite in cores from 12,709-713 ft. This test is 917 ft. lower on the anhydrite than Humble Oil & Refining Co.'s 1 J. A. Hurst, 18 miles to the southeast in 33-5n-8w, Greene County, which had top of anhydrite at 11,740 ft., or —11,530 ft. Last reported cores in the 1 Majors were below 12,723 ft., in anhydrite.

At Sandersville, in 31-10n-10w, also in Jones County, Union Sulphur Co. has run casing on its 1 Earline Parker, after taking side-wall cores. Casing was set through the Massive sand stringer, indicated at 6,919-25 ft., by electric log. Shows of oil have been found in the City Bank sand at 5,438-56 ft., and irregular oil stains at 5,484-5,507 ft. The Christmas sand, 5,707-16 ft., also indicated some oil possibilities on electric survey. Survey indicated the following tops and shows: Marine Tuscaloosa 6,646-6,802 ft., broken sand with no shows 6,813-78 ft., sand with show of oil 6,919-25 ft., Massive sand 7,056 ft., and the Comanche at 7,230 ft.

MISSISSIPPI WILDCAT FAILURES

Attala County: Stanolind Oil & Gas Co. 1 E. Steed, SE SW 4-13n-6e, dry, TD 7,108 ft., Midway 1,723 ft., chalk 2,448 ft., Eutaw 3,237 ft., Tuscaloosa 3,834 ft., Marine Tuscaloosa 4,254 ft., Massive sand 4,469 ft., Comanche 4,532 ft., Pennsylvanian 6,724 ft., elevation 329 ft., no shows reported.

Clay County: Atlantic Refining Co. 1 R. G. Dunning, NW SW 12-19n-16e, dry, TD 9,243 ft., side-wall cores 1,875, 3,787 ft recovered tight sand with no shows.

TEXAS GULF COAST

New Gasser ½ Mile Northeast of El Campo

HOUSTON.—Seaboard Oil Co. of Delaware has opened new gas production approximately ½ mile northeast of present production in the El Campo field of Wharton County. Its B-1 R. Holub in the W. D. Ivey Survey, gaged 3,232,000 cu. ft. of gas per day through a ¼-in. choke with 2,190 psi. flowing pressure on the tubing, and had an open flow calculation of 6,500,000 cu. ft. of gas per day. Sands showing gas were picked up in the sidetracked hole at 6,094-6,001 ft. Production string was set at 7,068 ft. and pipe perforated with 60 shots from 6,093-6,100 ft.

Potential gage has been run from Kirby Petroleum Co.'s new gas-condensate discovery southeast of old production in the Cedar Bayou field of Chambers County. The 1 Kirby Petroleum Co.-fee Tract 20, in the C. Smith Survey, 1 mile southeast of Rayzor et al 1 Muckelroy-Frymire unit gasser, flowed 38.64 bbl. of 49.6°-gravity condensate along with 1,275,000 cu. ft. of gas per day through a 3/16-in. choke and flowing pressure on the tubing was 2,125 psi., with 2,300 psi. on the casing. Total depth is 8,015 ft. and production is through perforations at 6,312-16 ft., with tubing set at 6,291 ft.

Tide Water Associated Oil Co. 1 J. D. Hudgins, West Bernard field discovery in Wharton County, 5 miles southeast of Lissie field and in GH&H Survey, flowed on potential gage 22 bbl. of fluid and 1,735,000 cu. ft. of gas with 1,350 psi. flowing pressure on the tubing. Total depth is 7,901 ft., and 5½-in. casing is cemented at 7,898 ft. with perforations for completion at 6,720-22 ft. and 6,706-12 ft. Cores taken from 6,710-20 ft. showed sand with oil and gas shows, and sand with odor of oil from 6,807-27 ft., and siltstone with shows of oil from 7,635-71 ft.

New sand for South Hutchins field in Wharton County has been opened by McDannald Oil Co. 2 K. C. Martin, in I&GN Survey. Drilled to a total depth of 6,515 ft., with plugged-back depth 6,100 ft., this well flowed an initial production of 43 bbl. of oil per day through a 6/64-in. choke, gas-oil ratio 1,600, tubing pressure 1,595 psi., casing pressure 2,000 psi. gravity 28.9°. Production is through perforations at 5,735-36½ ft.

A new pool for Burleson County, 12 miles southeast of Rockdale, has been opened by the Cresslenn Oil Co. 1 Nellie K. Gramm, in E. Saute Survey. On potential test gaged 18.56 bbl. of 38.3°-gravity oil on the pump from a sand topped at 3,440 ft. Total depth is 3,495 ft.

The 28 new locations reported this week included 8 wildcat starts, 1 each in Bee, Calhoun, Colorado, Fayette, Fort Bend, Live Oak, Newton and Victoria counties. Four successful wildcats were completed, a new oil pool opener for Burleson, a new gas-condensate pool discovery for Chambers County, and two new oil sands for South Hutchins field in Wharton County.

TEXAS GULF COAST SUCCESSFUL WILDCATS

Burleson County: New oil pool, Chriesman Area—Creslenn Oil Co. 1 Nellie K. Gramm, in Eliz Sante Sur., 12 mi. SE of Rockdale, TD 3,495 ft., top sand 3,440 ft., perf. 3,440-50 ft., IP: 19 bbl. oil per day on pump, gas-oil ratio 500 cu. ft., gravity 38.3°, no water.

Chambers County: New gas-condensate pool, SE Cedar Bayou area—Kirby Pet. Co. 1 Kirby Pet. Co. fee, Tr. 20, in C. Smith Sur., TD 8,015 ft., top sand 6,312 ft., perf. 6,312-16 ft., IP: 39 bbl. oil per day through a 3/16-in. choke, and 1,275,000 cu. ft. gas per day, gas-condensate ratio 33,000, TP 2,125 psi., CP 2,300 psi., gravity 49.6°, no water.

Wharton County: New oil sand, South Hutchins field—Perry R. Bass et al 5 Lacy W. Armour et al, in I&GN Sur., TD 6,000 ft., PBTD 5,859 ft., top sand 5,852 ft., perf. 5,852-58 ft., IP: 26 bbl.

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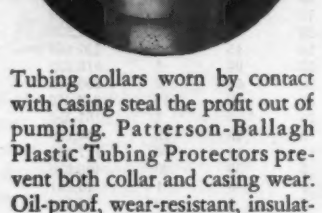

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oil per day through 16/64-in. choke, and 3,200,000 cu. ft. gas per day, gas-oil ratio 125,487 cu. ft., TP 2,200 psi., CP 2,225 psi., gravity 47.6°, no water.

New oil sand, South Hutchins field—McDannald Oil Co. 2 K. C. Martin, in I&GN Sur., TD 6,515 ft., PB 6,100 ft., top sand 5,735 ft., perf. 5,735-36½ ft., IP: 45 bbl. oil per day through 6/64-in. choke, gas-oil ratio 1,600 cu. ft., TP 1,595 psi., CP 2,000 psi., gravity 28.9°, no water.

TEXAS GULF COAST WILDCAT FAILURES

Liberty County: Deep Rock Oil Corp. 1 Andrew McClosky, Dayton Area, in H&TC Sur., 1 mi. off SE flank production at Dayton Dome, dry, TD 10,020 ft.

General Crude Oil Co. 3 Phoenix Dev. Co., in Jasse Devore League, OTD 7,781 ft., ST TD 3rd hole 7,216 ft., dry, hole junked.

Live Oak County: V. G. Schimmel et al 1 Clay West Abbey, in Antonio Fernandez Sur., 3.7 mi. SSW of Geo. West, dry, TD 4,015 ft.

Polk County: Gem Oil Co. 1-A Kavanaugh & Collins, in A. Viesca League, ¾ mi. N of E side production at Livingston field, dry, TD 7,269 ft.

San Jacinto County: Butcher-Arthur, Inc. 2-C Foster Lbr. Co., in Wm. M. White Sur., dry, TD 5,671 ft.

Victoria County: Humble 1 C. K. McCan et al, in John W. Ward Sur. 34, 9¾ mi. N of Telferner, dry, TD 4,916 ft.

EASTERN TEXAS

San Augustine County To Get 2 Offsets

DALLAS.—The new Pettit limestone field in San Augustine County, 5 miles north of San Augustine, opened by Hiawatha Oil & Gas Co. 1 Johnson, has stirred considerable leasing and this week Hiawatha announced locations for two offset tests to be drilled immediately. A north offset, in the Quirk Survey, will be the 1 A. Whitton. A west offset is planned but the farm name was not mentioned.

A new exploration test in the Joaquin area of Shelby County was announced by Paul H. Pewitt, Longview, Tex., as his 1-E Pickering Lumber Co. Location is on a 530-acre tract 5 miles southeast of Joaquin. It is scheduled to drill to 7,000 ft. In Cherokee County, 4 miles northwest of Jacksonville, Morris Coats was moving in rig for a Woodbine exploration on the J. W. Francis tract in the Jose Pineda Survey. Location is on a farmout from Phillips Petroleum Co., which was said to be contributing dry-hole money. In Houston County, John Moore et al will drill a 7,800-ft. Woodbine test in the Austonio area southwest of Crockett. It was said to be on a spread of some 2,000 acres obtained from Continental Oil Co., in the James W. Harvey and M. J. Chamar surveys. Location of the test is on Southern Pine Co.'s land in the west corner of the Harvey Survey.

Humble Oil & Refining Co. continued testing at its 1 P. H. McKnight, Wood County distillate discovery. On an 18-hour test, through open hole from 8,935-66 ft., the flow was about 1½ bbl. of distillate an hour, with 31,223 cu. ft. of gas. After a second acid treatment, distillate production was up to about 2½ bbl. an hour.

In Panola County, 2 miles southeast of Deadwood, Continental 1-C Louis Werner was drilling below 6,035 ft. in limestone and shale. Top on the Pettit, by cores, was placed at 5,931 ft., on an elevation of 306 ft. Continental and Byrd Frost 1 R. M. Royall, Anderson County wildcat, northwest of Slocum, was drilling below 8,347 ft. Sanders & Murchison 1 R. F. Broadway, east of Blackfoot in Anderson County,

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logged base of the massive anhydrite at 8,840 ft., and was below 8,862 ft. in Bacon limestone, with no shows reported. The Texas Co. 1 Ester L. Irvin, 1 mile southwest of Stony Point Church, Freestone County, was below 6,123 ft. in shale and limestone.

EAST TEXAS WILDCAT FAILURES

Fannin County: McCurdy Bros. 1 W. P. & W. D. Springfield, Wm. Onstat Sur., 7 mi. NE Bonham, dry, TD 2,882 ft. in Palezoic.

Leon County: Carter-Gragg Oil Co. 1 Emma Dora Carter, C. C. Goodman Sur., 5 mi. SE Oakwood, dry, TD 5,873 ft., sample tops: Pecan 4,005 ft., Austin 5,171 ft., sub-Clarksville 5,440 ft., Woodbine 5,774 ft., DST on gas shows 5,503-26 ft. failed.

Kaufman County: Humble Oil & Refining Co. 1 H. L. Guy, J. S. Ables Sur., 2 mi. N Kemp, dry, TD 9,800 ft., sample tops: Woodbine 2,990 ft., Georgetown 3,550 ft., Paluxy 4,489 ft., Massive 5,394-5,650 ft., Travis Peak 6,255 ft., Cotton Valley 7,545 ft., Smackover 9,480 ft., elevation 403 ft.

Panola County: Chicago Corp. 1 Evie McDaniel, E. Lewis Sur., 2 mi. NE Dotson, dry, TD 6,949 ft., lower Cretaceous 2,854 ft., Glen Rose 3,814 ft., Massive 5,297-5,596 ft., James 5,982 ft., Pettit 6,246 ft., Travis Peak 6,625 ft., elevation 349 ft.

Titus County: Morris Coats 1 Ben Lackey, Joseph Leech Sur., 4 mi. NE Winfield, dry, TD 5,493 ft., sub-Clarksville 3,365 ft., Woodbine 3,818 ft.

CALIFORNIA

Deep Sand Well At Long Beach Flowing 1,120 Bbl.

LOS ANGELES.—Shell Oil Co.'s apparent deep discovery in the Long Beach field, the 2 Dolley, 29-4s-29w, has been restored to production and is flowing an estimated 1,120 bbl. of 32.7°-gravity crude to tanks daily through an 18/64-in. choke. According to Shell, 7-in. casing is cemented at 10,030 ft. and the well is producing through perforations at 10,056-10,192 ft. and 10,247-10,317 ft., a total of 216 ft. of oil sand. The 2 Dolley has created considerable interest in the area, and it is quite likely that an extensive drilling campaign will result. It is reported that deep rights for all nearby acreage has already been purchased, with many companies paying extremely high bonuses for these rights.

The Palomar Petroleum Co. announced late last week that it is starting to set 6⅝-in. casing, preparatory to testing its 1 Tyrell in 13-8s-1w, an exploratory venture in the Temecula area of Riverside County. Five separate intervals between 1,500 ft. and total depth of 2,720 ft. will be tested.

Testing again has been delayed at R. E. Havenstrite's deep test in the Del Valle field, the 15 Lincoln, 16-4n-17w. Trouble this time is due to difficulties in running liner. Total depth of the well is 12,868 ft. and 5½-in. casing is set at 10,331 ft. The 15 Lincoln is credited with topping a thick section of well-saturated oil sand at a depth of 10,140 ft. This is deeper than present producing horizons in the field, and confirmation of deep production here would probably result in a great increase of activity.

Three major companies are preparing to start wells in the new Montalvo area of Ventura County where Standard Oil Co. of California earlier this year scored what appears to be a major discovery. The Texas Co. has staked location for the 1 Max Fleischman in 24-2n-23w, and Superior Oil Co. has staked location for the 1 Saticoy in 10-2n-22w. Meanwhile, Richfield Oil Corp. is grading location and building roads for the 1 Del Cielo in 30-2n-22w. Richfield's well is located about 3,800 ft. north of the Standard 65-3 McGrath, con-

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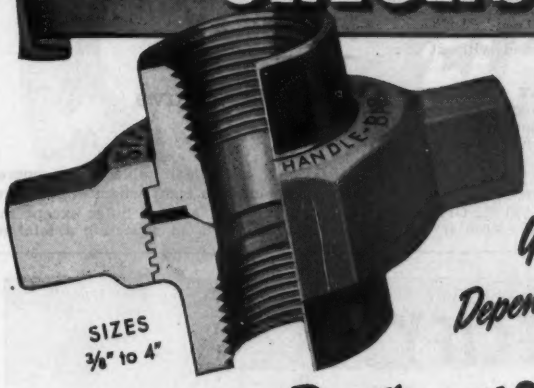

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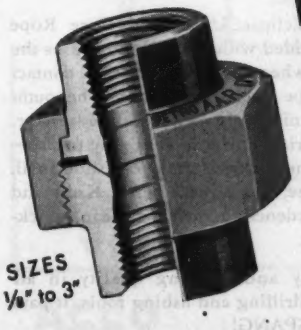

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formation test, which currently is drilling below 9,000 ft. and rapidly approaching completion depth.

Barnsdall Oil Co. has staked location for an important wildcat venture 8 miles south of the Lompoc field in Santa Barbara County. The test will be known as the 1 Salsiduedes, and it will be located on the Rancho Canada del Salsipuedes in Section 16-6n-33w. This is near the area where Tide Water Associated drilled without success nearly 10 years ago.

CALIFORNIA WILDCAT FAILURES

Kern County, Cymric Area: Independent Exploration Co. 2 Anderson, 18-29s-21e, dry, elev. 993 ft., Carneros sand 1,353 ft., TD 2,000 ft.

Poso Creek Area: Westates Petroleum Corp. 1 Davidson, 36-27s-27e, dry, elev. 649 ft., Pyramid Hills 2,930 ft., Grit 3,030 ft., Vedder 3,045 ft., TD 3,098 ft.

Yolo County, Dunnigan Hills Area: Standard Oil Co. of Calif. 1 Guiguere, 7-11n-1w, dry, elev. 249 ft., TD 2,750 ft.

Winters Area: Shell Oil Co., Inc. 3-1 Winters Unit, 18-8n-1e, dry, elev. 114 ft., TD 5,195 ft.

MICHIGAN

Wildcatters Have Poor Week

SAGINAW.—Michigan oil and gas operators cleaned up eight wildcat operations in the past week, all dry holes except for one small gas well, in reporting a total of 26 completions. Twenty-four new locations were announced.

Of the completions 10 were oil producers for total initial daily potential of 970 bbl., and 6 were gas wells, their combined potential being 19,650,000 cu. ft. a day. There were three dry holes in addition to the seven wildcat failures.

Most of the new production was from a 700-bbl. completion in the Garfield-Newaygo pool. Other producers, all below 100 bbl. a day, were 2 in Allegan County, 1 in Bay, 2 in Montcalm, 1 in Ottawa, 2 in Tuscola, 1 in Van Buren.

Six of the new locations are in Garfield-Newaygo, 5 in Allegan County, 3 in Clare County, 2 each in Montcalm, Tuscola and Oceana, and 1 each in Montmorency, Isabella, Ottawa and Van Buren counties.

MICHIGAN WILDCAT PRODUCER

Ottawa County, Zeeland Township: Tri-County Development Co. 1 Troost Estate, SE NE 11-5n-14w, gas well, 500,000 cu. ft., TD 997 ft.

MICHIGAN WILDCAT FAILURES

Huron County, Port Austin Township: Charles W. Teater 1 Knoblock, NE SW SE 31-19n-13w, dry in Traverse limestone, TD 1,760 ft.

Isabella County, Nottawa Township: Merritt Drilling Co.-Clayton Development Co. 1 Matteson, SW SW SE 12-15n-5w, dry in Dundee, TD 3,788 ft.

Kent County, Cannon Township: Phinney Brothers 1 Anderson, SE NW SE 16-8n-10w, dry in Traverse limestone, TD 2,441 ft.

Montcalm County, Ferris Township: McClure Drilling Co. 1 Neff Hansen, SE SE NW 9-11n-5w, dry in Detroit River, TD 3,569 ft.

Newaygo County, Home Township: Michigan Consolidated Gas Co. 1 Blake, C-32-16n-12w, dry, TD 989 ft.

Ottawa County, Jamestown Township: Ford Oil Co. and Arthur J. Boeve 1 Wiers, SE NE NW 16-5n-13w, dry in Traverse limestone, TD 1,690 ft.

Osceola County, Sylvan Township: Merrill Drilling Co. 1 McLaughlin, N½ SE NE 34-18n-7w, dry, TD 5,144 ft.

APPALACHIAN FIELD

Maryland Getting New Test

PITTSBURGH.—In district 8, Garrett County, Maryland, Columbian Carbon Co. has started drilling a wildcat on the J. W. Durr (Harvey Fike) farm which, on the Oakland Quad, is located 1.06 miles east 79 degrees 30 minutes, and 3.31 miles north of 39 degrees 15 minutes, or about 8½ miles southwest of Oakland. The new test is located on the Deer Park anticline which is between the Briery anticline to the west, on which two very successful lower Devonian gas wells have been completed and a new test starting, and the Blackwater anticline on which there are two good Oriskany gas wells.

West Virginia.—On the Briery anticline in Portland district, Preston County, West Virginia, William E. Snee, Orville Eberly et al are building a rig for a test on the Virginia Cuppet farm located 3,000 ft. southwest of the good Onondaga chert gas well on the Cora E. Lewis farm.

In Elk district, Kanawha County, Glenn Dearth is drilling through the Oriskany sand in the test on B. A. Wise tract which from a surface elevation of 769 ft. topped the Corniferous lime at 5,028 ft., Oriskany 5,152 ft., with a high gage of only 315,000 cu. ft. at 5,165-79 ft.

New locations in West Virginia totaled 16, in Sherman district, Calhoun County; Buffalo district, Clay County; Cabin Creek district, Kanawha County; Lincoln and Union districts, Marion County; Kermit district, Mingo County; Warren district,

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Upshur County; Grant district, Wayne County; Clay and Reedy districts, Wirt County; Williams district, Wood County; Baileysville and Oceana districts, Wyoming County.

Southwest Pennsylvania.—On Chestnut Ridge in Georges Township, Fayette County, New Penn Development Corp. et al topped the Tully lime at 6,504 ft. in No. 2 Mary I. Smith, which from a surface elevation of 2,390 ft. places it at —4,114 ft. This is lower on structure than the large No. 1 well but higher on structure than the Hartman well to the south.

New York.—New locations totaled three; in Boggs and Wayne townships, Armstrong County; and in Allenport Boro, Washington County.

WEST VIRGINIA SUCCESSFUL WILDCATS

Fayette County, Falls district: Columbian Carbon Co. 944 Gauley Mountain Coal Co. 890,000 cu. ft. gas, Maxton sand topped at 1,639 ft., rock pressure 495 psi., 18 hours, TD 1,647 ft.

Kanawha County, Elk district: United Fuel Gas Co. 5,828 Numa Black Coal Co., 4,075,000 cu. ft. gas, TD 5,222 ft., elevation 951 ft., Corniferous lime 5,064 ft., Oriskany 5,177-5,220 ft., rock pressure 825 psi., 48 hours.

WEST VIRGINIA WILDCAT FAILURE

Fayette County, Mountain Grove district: Godfrey L. Cabot, Inc. 1,225 Holt & Snyder, dry, TD 2,500 ft., Big lime 1,657 ft., Inujn 1,970-2,058 ft., show gas 2,217 ft., brown shale 2,395-2,403 ft., no Berea, plugged after shot.

CANADIAN FIELDS

Leduc Developments Moving at Fast Pace

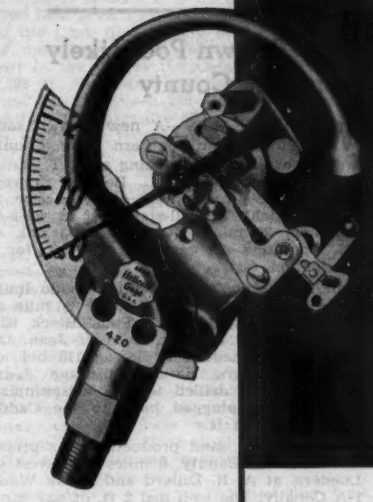
CHATHAM.—In the Leduc field, Imperial-Leduc 5, LSD 8, 21-50-26w4, is being completed as the fifth producer. No figures on the potential have been released, but it is reported comparable with the four earlier wells. On first test at 4,975-5,020 ft. the new well had a 3,200-ft. rise of oil in 1 hour. On a second test at 5,020-40 ft. the well began to flow 41 minutes after tester was opened, and flowed 300,000 cu. ft. gas with a good show of 39.3°-gravity oil. Following a third test at 5,40-60 ft. coring was resumed, with another test scheduled for 5,060 ft. The well offsets the discovery to the west, extending the proven area in that direction.

Imperial-Leduc 6, LSD 1, 22-50-26w4, is below 4,915 ft. with early completion expected. Imperial Leduc 7, LSD 4, 15-50-26w4, is below 4,484 ft. and Imperial-Leduc 8, LSD 7, 26-50-26w4, below 4,258 ft. Imperial-Leduc 10, new test in LSD 11, 26-50-26w4, has spudded and is below 798 ft., and Imperial-Leduc 11, offsetting No. 5 to the north is in LSD 9, 21-50-26w4.

Imperial Oil has posted an initial price of $2.67½ per barrel for Leduc oil of 40-41 gravity, comparing with the Turner Valley 40-40.9° crude at $2.96, with allowance for 9½ cents pipe line charge and freight rate from Leduc to East Calgary. As there is no appreciable differential in the gravity of Leduc crudes so far, no provision has been made for any price differential.

Okalta Leduc 1, LSD 13, 7-50-25w4, 2 miles southeast of Imperial 4, is below 4,408 ft. after striking 1,300,000 cu. ft. gas in lower Cretaceous at 4,330 ft. following 200,000 cu. ft. in the Viking sand. Lime is expected at 4,580 ft. British-American Pyrcz 1, LSD 12, 25-50-26w4, ½ mile east of No. 3 producer, is deepening from 4,120 ft. after installing heavier rig. Globe-Leduc West 2, LSD 8, 34-50-26w4, ½ mile northwest of production, is below 4,320 ft.

South of the field, McColl-Frontenac 14-14 Wizard Lake, LSD 14, 14-48-27w4, is



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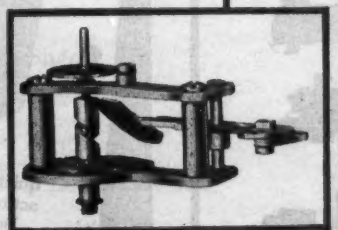

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deepening after drill-stem test 100 ft. in Devonian at 5,096 ft. showed oil and gas in a rise of mud. McColl-Frontenac East Wetaskiwin 3-22, LSD 3, 22-46-23w4, is coring below 4,901 ft. after encountering slight showings. McColl-Frontenac Bigstone Lake, 1-20, LSD 1, 20-46-26w4, is below 5,083 ft. and drilling close to the Devonian. Three other tests are at shallower depths, with six locations.

Morinville.—In the Morinville district, Imperial-Morinville 1, LSD 9, 30-56-24w4, is deepening below 4,287 ft. after a spectacular burst of gas from an horizon above the Devonian. The area under test is north and east of the Leduc field, but geological conditions are believed similar.

Steveville.—In the Steveville - Princess field, Standard-Pacific 68-8, LSD 14, 8-19-11w4, is in Madison lime at 3,324 ft. and testing production. Princess 14-22-A, LSD 8, 22-20-12w4, is at 4,120 ft. with ⅜-in. set to drill through the Devonian.

Pakowki.—In the Pakowki area, southern Alberta, McColl-Union 7-13, LSD 7, 13-5-6w4, finished at 3,226 ft. with around 30,000,000 cu. ft. gas from the Bow Island sand. McColl-Union 7C-6, LSD 7, 6-5-5w4, is drilling in the same general area.

Turner Valley.—In North Turner Valley, Home-Millarville 25, LSD 3, 33-20-3w5, with Madison at 8,175 ft., is deepening below 8,662 ft. for the lower porous horizon, after getting 110 ft. of porosity with good indications in the upper Madison.

Hanna.—In the Hanna area, Berry Creek Petroleums 1, LSD 3, 9-31-14w4, has been shut in as a gasser at 4,286 ft. Hanna Utilities, Ltd., has been incorporated with head office at Calgary to handle distribution of the production to the town of Hanna. Co-Op 2, a joint test by E. G. Lawrence and Saskatchewan Federated Co-Operative, Ltd., has location in LSD 3, 13-14-31w4. Production from the discovery well is estimated around 5,000,000 cu. ft.

N. CENTRAL TEXAS

New Strawn Pool Likely For Clay County

WICHITA FALLS.—A new Strawn sand discovery for southern Clay County was reported in the making at L. T. Burns 1 Tally, Block 12, J. L. Belcher Survey, and some 2½ miles west of production in the Joy field. A drill-stem test at 4,449-66 ft., open 30 minutes, recovered 3 bbl. of oil. Operators set casing at 4,449 ft. for a production test.

In Northern Young County, Caddo limestone production was extended ½ mile at Davis Investment Co. 1 Pool, Block 622, TE&L Survey, 3 miles south of Jean. On completion potential it flowed 110 bbl. of oil in 6 hours, natural, through ¾-in. choke. It was drilled to the Mississippian before being plugged back to the Caddo pay at 3,955-83 ft.

New shallow sand production was promised in Jones County, 3 miles southwest of Lueders, at A. R. Dillard and Frank Wood 1-A Conally. The well had 2 ft. of pay sand at total depth, 2,034 ft. According to reports, the hole filled several hundred feet with oil after standing a short time. Later, on the pump, it made 41½ bbl. of oil a day. Location is on a block of 1,400 acres in Lot 1, A. W. Hill Survey, assembled by Orion Danel, Wichita Falls.

North of Benton field production, and 2 miles northeast of Nocona in Montague County, S. D. Johnson et al 5 Reynolds, Block 9, ETRR Survey, perforated with 60 shots in the conglomerate zone at 5,180-90 ft., kicked off and flowed 233 bbl. of oil in 12 hours. At the end of the flow period, casing pressure was 200 psi., and tubing pressure 123 psi. Total depth is 5,200 ft.

NORTH CENTRAL TEXAS SUCCESSFUL WILDCAT

Young County: Davis Investment Co. 1 C. E. Pool, Sec. 622, TE&L Sur., 3 mi. S Jean, flowed 110 bbl. 44°-gravity oil in 6 hours, ¾-in. choke, Caddo limestone 3,962-4,020 ft., TD 5,020 ft.

NORTH CENTRAL TEXAS WILDCAT FAILURES

Archer County: Fain & McGaha 2 Wm. E. Huff "A," M. Fanning Sur., A-128, 4 mi. E Holliday, dry, TD 4,350 ft., lower Hull Silk sand, with show oil, 4,316 ft.

Alexander Goldsmith 1 R. L. Kempner, Blk. 63, KWVFL Sur., A-115, 2½ mi. NW Holliday, dry, TD 4,858 ft., Strawn 3,600 ft., Caddo 4,440 ft., Ellenburger 4,838 ft.

Clay County: Timberlake & Kelleher 1 J. B. Dunn, Blk. 125, Byers Subd., 3 mi. NE Byers, dry, TD 2,003 ft. in shale.

Cooke County: R. B. Hollandsworth 1 T. B. Cook, J. Lewis Sur., A-567, 5 mi. S Myra, dry, TD 1,685 ft. in shale.

Voth Bros. Drilling Co. 1 A. Pulte, J. Shields Sur., A-911, 3½ mi. SE Myra, dry, TD 2,052 ft., Ellenburger 2,020 ft.

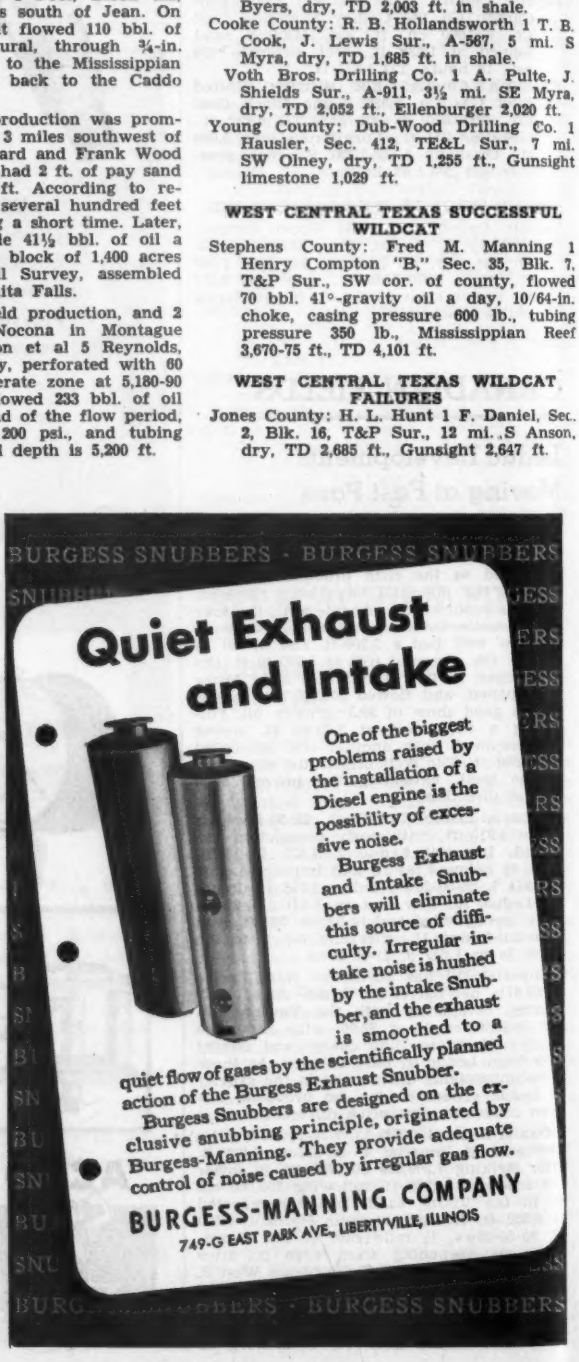
Young County: Dub-Wood Drilling Co. 1 Hausler, Sec. 412, TE&L Sur., 7 mi. SW Olney, dry, TD 1,255 ft., Gunsight limestone 1,029 ft.

WEST CENTRAL TEXAS SUCCESSFUL WILDCAT

Stephens County: Fred M. Manning 1 Henry Compton "B," Sec. 35, Blk. 7, T&P Sur., SW cor. of county, flowed 70 bbl. 41°-gravity oil a day, 10/64-in. choke, casing pressure 600 lb., tubing pressure 350 lb., Mississippian Reef 3,670-75 ft., TD 4,101 ft.

WEST CENTRAL TEXAS WILDCAT FAILURES

Jones County: H. L. Hunt 1 F. Daniel, Sec. 2, Blk. 16, T&P Sur., 12 mi. S Anson, dry, TD 2,685 ft., Gunsight 2,647 ft.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Shackelford County: Ungren & Frazier 1 W. D. Baker, N. M. Gladden Sur., 4 mi. S Lueders, dry, TD 1,860 ft.

SOUTHWEST TEXAS

New Pool Opened In Aransas County

CORPUS CHRISTI.—In Aransas County, 4½ miles north of Rockport, William Herbert Hunt Trust Est. 1 Spencer-Crane opened a new oil field on Live Oak Peninsula. Drilled to a total depth of 8,370 ft., this well on potential test gaged 185 bbl. of oil per day through a 9/64-in. choke, with 1,200 psi. tubing pressure, and gas-oil ratio of 858. Production is through perforations at 7,126-36 ft. On previous test through perforations at 7,058-65 ft., open 6 hours, it flowed water cushion and gas, through a ¼-in. choke, with 2,700 psi. working pressure, and 3,300 psi. bottom-hole pressure flowing. Operators plan to dual-complete for a gas-condensate well in this zone. This well is located in the C. O. D. Gilliland Survey.

Gas-condensate production of McAllen field, Hidalgo County, has been extended approximately ¾ mile eastward on the southeast flank by Coastal Refineries and Mayfair Minerals 1 J. J. Lynn, deepening job in the old R. E. Hardin 1 Lynn. This well flowed 4,150,000 cu. ft. gas per day through a ¼-in. choke with 2,750 psi. tubing pressure, casing sealed, through perforations at 7,500-40 ft. Estimated open flow production is 32,000,000 cu. ft. gas per day. This well is located on Lot 202 of Kelly-Pharr subdivision.

Magnolia Petroleum Co. 2 Duval Ranch-State Section 76, in northwestern Duval County, is completing through perforations at 1,322-27 ft. as a new oil discovery in the "76" field area, approximately 2 miles south of the Casa Blanca field and 4 miles west of the Government Wells field. Drill-stem test in the top of the Cole sand, at 1,297-1,308 ft., developed 272 psi. working pressure and recovered 320 ft. of gas-cut mud bottom-hole pressure 500 psi. flowing. Test at 1,322-29 ft. recovered 780 ft. of pipe-line oil and 30 ft. of sand in 45 minutes, with 4 psi. working pressure. The 7-in. casing was set on bottom at 1,329 ft. for the completion. This well is located in the CCSD&-RGNG Survey 76.

Gravis & Mitchell et al 1 Robert Schallert, wildcat in Survey 255, on the northwest flank of the Palangana salt dome, Duval County, flowed 20 bbl. of oil per hour through perforations at 1,770-80 ft. on a drill-stem test through a 3/16-in. top choke and ¼-in. bottom choke. Drill-stem test through perforations in the lower sand, at 2,686-94 ft., using ¼-in. chokes on top and bottom, recovered 2,300 ft. of pipe-line oil, 48°-gravity, 69 Octane, in 10 minutes. Operators are waiting on storage before making final dual-oil completion. This well is located approximately 6 miles north of Benavides.

The 44 new locations reported this week include 15 wildcat starts, 2 each in Duval, Willacy, Williamson, and Zapata, and 1 each in Brooks, Cameron, Jim Hogg, Jim Wells, San Patricio counties.

SOUTHWEST TEXAS SUCCESSFUL WILDCATS

Brooks County: New oil pay, LaGloria field—Magnolia Petroleum Co. 4 T. S. Proctor, Lot 11, Blk. 2, Falfurrias Farm & Garden Tracts, top pay 7,482 ft. (Proctor sand), TD 7,710 ft., perf. 7,483-93 ft., IP: 24 bbl. oil per day through a ¼-in. choke, jetting with net gas-oil ratio 300 cu. ft., TP 560 psi., casing sealed, gravity 42°, no water.

Duval County: New gas pool—J. W. Gor-

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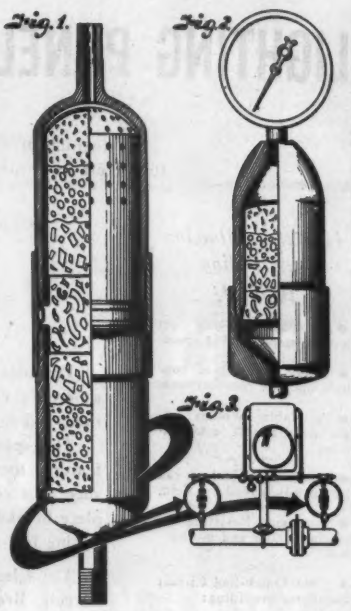

Fig. 1. Meter Installation—For removing H_2S, Carbon Dioxide and moisture from lines ahead of meters, Bourdoin tubes, and automatic equipment operated by gas pressure.

Fig. 2. High and Low pressure gas well and Christmas Tree installation.

Fig. 3. Gas meter installation as shown.

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man 3 F. D. Lowe, AB&M Sur. 76, 1½ mi. E-NE of Labbe field and 1½ mi. S-SE of County Line field discovery, top pay 2,468 ft., TD 2,502 ft. perf. 2,471-74 ft., IP: gas well, shut in, no water.

SOUTHWEST TEXAS WILDCAT FAILURES

Bastrop County: C. W. Voyles & Jergens 1 Jack Smith, in J. Manuel Bangs Sur., 8½ mi. W-SW of Bastrop, dry, TD 2,960 ft. in Edwards lime.

San Patricio County: Nelson Bunker Hung Trust. Est. 1 Turner Bros., Lot 36, Presidio Irrigation Co. Sur. A-317, 4½ mi. SE of Odem, dry, TD 6,510 ft.

Starr County: Sun Oil Co. 1 E. Izaguirre, Jr., in E. Izaguirre, Jr. lease in La Sal Colorado Grant, 5 mi. W-NW of North Sun field, dry, TD 5,005 ft.

Webb County: Houser & Campbell and W. C. McBride, Inc. 1 Garcia Est., in Los Ojuelos Grant, 3 mi. SE of Mirando City, dry, TD 2,103 ft.

LA.-ARK.

Bossier Parish Test May Have Something

SHREVEPORT.—In Bossier Parish, 2½ miles northeast of the Elm Grove field, M. A. Halsey et al 1-B Skidmore, SE SE 1-16n-11w, reported a showing of gas and some oil, but a drill-stem test was unsuccessful. Bottomed at 5,837 ft. in Travis Peak, the well had been plugged back to test the Lower Cretaceous, topped at 2,654 ft., in which cores had shown good oil odor and stain between 2,617-32 ft. However, the test, at 2,620-32 ft., open 20 minutes, recovered 120 ft. of fluid, being 40 ft. of oil and oil-cut mud, and 80 ft. of salt water. There was no pressure. Operators were to run electric log.

In Red River Parish, 4½ miles west of Coushatta, Union Producing Co. 1 Anna Campbell, 20-12n-10w, was coring below 5,030 ft., after a drill-stem test at 5,012-30 ft., open 17 minutes, recovered 10 ft. of gas-cut mud, with no pressure. Northeast of Saline, Bienville Parish, Union Producing and Pure Oil Co. 1 L. P. Frazier, 14-14n-6w, was drilling in hard shale and limestone at 5,472 ft. C. H. Murphy, Jr., 1 W. C. Agurs, 7-16n-16w, Caddo Parish, was preparing a drill-stem test in Travis Peak at 6,365-72 ft., total depth. Four miles north of the North Lisbon field, Claiborne Parish, Hassie Hunt et al 1 G. W. James, 10-22-4w, was drilling below 6,536 ft. No formation tops were reported in this projected 8,000-ft. Cotton Valley test. In DeSoto Parish, Skelly Oil Co. 1 Nash, 20-12n-16w, was drilling ahead below 8,670 ft. in Travis Peak.

Arkansas wildcat reports included McAlester Fuel Co. 1-A J. W. McDonald, northwest of the McKamie field, Lafayette County, drilling below 7,620 ft. West of the Midway field, in 8-15s-24w, N. H. Wheless 1 T. R. Knighton, was below 4,750 ft. It is scheduled to test the Smackover around 6,500 ft. A 3,500-ft. Smackover test 7 miles southwest of Ashdown, Little River County, was reported nearing the goal with no shows indicated. It is Frank Frankel 1 N. Locke, NE NW NW 19-13s-30w, which was drilling below 3,405 ft.

NORTH LOUISIANA SUCCESSFUL WILDCAT

Red River Parish: British-American Oil Producing Co. 1 Trixie Wimberly, NW SW SE 2-13n-10w, TD 7,508 ft., PB 2,775 ft., perforated in Eagleford sand 2,677-79 ft., pumped 10 bbl. oil and 150 bbl. salt water.

NORTH LOUISIANA WILDCAT FAILURES

Franklin Parish: C. H. Murphy, Jr., 1 West Virginia Timber Co., SE SE 32-16n-8e, dry, TD 4,233 ft.

Union Parish: Paul E. Parsons 1 Gordon Taylor, SW NW SE 34-22n-1e, dry, TD 3,169 ft., Wilcox 1,090 ft., Midway 1,480 ft., chalk 2,025 ft., Blossom 2,450 ft., elevation 168 ft., no shows reported.

C. W. Sharp and J. E. Kemp 1 Z. C. Robin, NW NW NW 28-21n-1w, TD 2,543 ft.

ARKANSAS WILDCAT FAILURE

Ashley County: McAlester Fuel Vo. 1-D Crossett Lumber Co., NE NE 7-16s-6w, dry, TD 3,810 ft., no tops reported.

PERMIAN BASIN

Crockett County May Get New Ellenburger Pool

MIDLAND.—Heavy flow of gas and recovery of some distillate was reported at Sinclair-Prairie Oil Co. and Atlantic Refining Co. 1-66 University, northeastern Crockett County wildcat. A drill-stem test of the Ellenburger at 7,390-7,438 ft. brought gas to the surface in 1 minute, at a flow estimated at 10,000,000 cu. ft. a day. When pipe was broken down, the recovery was 60 ft. of distillate. Operators were prepared to drill ahead. Top on the Ellenburger was 7,396 ft. Location of the wildcat is 8½ miles northeast of the Todd Deep field.

In southwestern Andrews County, Pure Oil Co. and Humble Oil & Refining Co.'s prospective Silurian extension to the Dollar Hide field, was drilling ahead below 8,862 ft. on its way to the Ellenburger, after finding water in the Silurian. A 3-hour drill-stem test at 8,690-8,740 ft. recovered 2,015 ft. of sulfur water, with no shows of oil or gas. Base of the Silurian and top of the Montoya, of the upper Ordovician, was tentatively placed at 8,715 ft. This test has indicated oil production in the Wichita Albany, of the lower Permian; the Devonian, and the Silurian, above the indicated water table.

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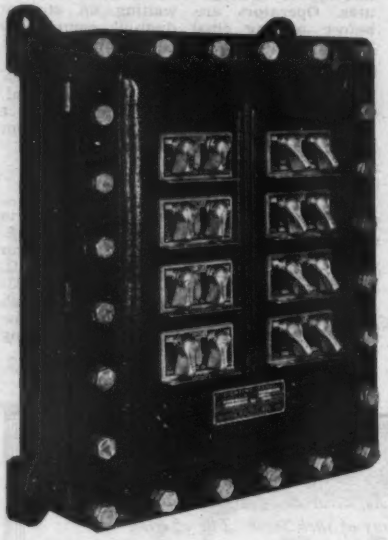

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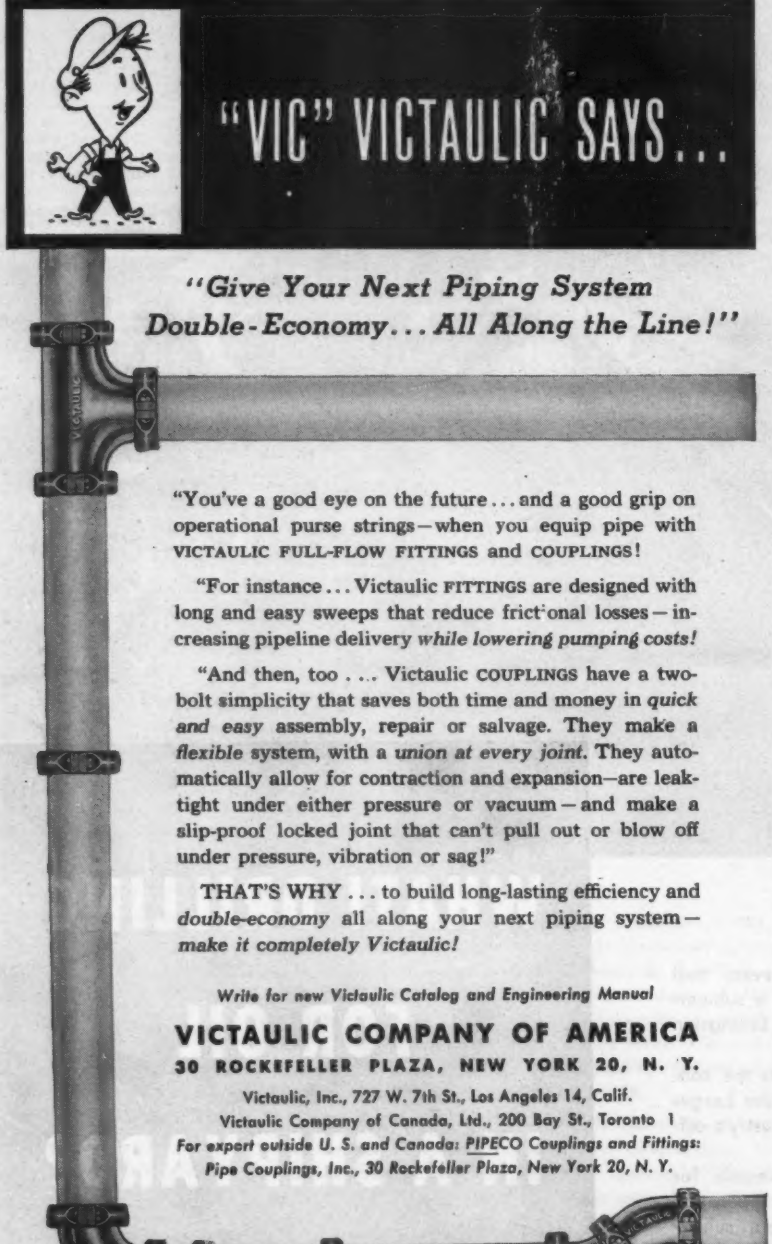
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west offset to the Wolfcamp discovery, between the Clara Couch and Olson fields of western Crockett County, was testing from perforations at 5,726-36 ft. In 14 hours, operators recovered 8 bbl. of oil and 18 bbl. of sulfur water, then squeezed and reperforated at 5,705-20 ft. The second set of holes yielded 3 bbl. of oil, with no water reported, in 17 hours on the swab. Treatment of 1,000 gal. of acid resulted in a recovery of 49 bbl. of oil and 52 bbl. of acid and load water, in 17 hours.

Gulf Oil Corp. 430-E Goldsmith, Ellenburger exploratory test ¾ mile northwest of the Devonian discovery in the Goldsmith field of Ector County, reported thinning of the deeper formations, but was said to be running some 250 ft. high on the Simpson, in relation to the Devonian discovery, 421-D Goldsmith. Log on the 430-E Goldsmith placed the Silurian at 8,445 ft., and the Montoya, upper Ordovisian, at 8,540 ft. Top of the Simpson was 8,765 ft., on an elevation of 3,127 ft. Operators were last reported coring below 9,068 ft., still in the Simpson.

In the Dollar Hide field, two extension wells were ready for completion. On the field's west side, Magnolia Petroleum Co. 4-B Cowden, Section 4, Block A-35, made initial potential of 756 bbl. of 42.1°-gravity oil from perforations at 8,342-8,456 ft. One-half mile southeast of production, Union Oil Co. 3 Cowden, Section 7, Block A-35, was testing the Devonian through perforations at 7,610-40 and 7,755-90 ft. An 8,000-gal. acid treatment was to be used. Object in testing the Devonian, since the well already has made completion potential of 756 bbl. of oil a day from the Silurian at 8,342-8,456 ft., was to complete the well as a dual producer. It would be the first for the field.

A good flowing well on the southwest side of the Jones Ranch field, northwest corner of Gaines County, was reported. Amerada Petroleum Corp. completed its 2-A Jones, Section 3, Block A-6, for a daily flowing potential of 1,053.3 bbl. of 42.4°-gravity oil from pay at 11,276-12,924 ft. Gas-oil ratio was 304 cu. ft.

WEST TEXAS SUCCESSFUL WILDCAT

Crockett County: Stanolind Oil & Gas Co. 1-TT University, Sec. 12, Blk. 29, University Lands, ½ mi. N same company's 1-GG University, flowed 63 bbl. oil and 1 bbl. salt water in 24 hours, 27/64-in. choke, Ellenburger pay 8,100-44 ft., 43°-gravity oil, casing pressure 480 lb., tubing pressure 400 lb., GOR 5,988:1, TD 9,000 ft.

WEST TEXAS WILDCAT FAILURES

Crockett County: Amerada Petroleum Corp. 1 University "CTA," Sec. 23, Blk. 42, University Lands, NE corner of county, dry, TD 8,826 ft., Black shale 8,102 ft., Ellenburger 8,102 ft., Wilberns sand 9,080 ft., elevation 2,613 ft.

Ted Weiner 1 Isabell Vaughan, Sec. 86, Blk. OP, GC&SF Sur., 7½ mi. E Todd Deep field, dry, TD 7,785 ft., San Andres 1,510 ft., no Simpson logged, Ellenburger 7,540 ft.

Ector County: Cities Service Oil Co. and Sinclair Prairie Oil Co. 1 Wooten, Sec. 12, Blk. B-14, PSL Sur., 5½ mi. W Judkins, dry, TD 8,335 ft., Yates 2,610 ft., Strawn 7,990 ft., Woodford shale 8,110 ft., elevation 2,909 ft.

Hockley County: Stanolind Oil & Gas 1 E. Gilmer, Lab. 23, Lodge 720, State Capitol Lands, 6 mi. N Levelland, dry, TD 4,900 ft., San Andres 3,770 ft.

Scurry County: Humble Oil & Refining Co. 1 C. J. Harrell, Sec. 78, Blk. 2, H&TC Sur., 11½ mi. NE Snyder, dry, TD 7,563 ft., Wolfcamp 3,840 ft., Cisco 4,915 ft., Strawn 7,040 ft., Ellenburger 7,425 ft.

TEXAS PANHANDLE WILDCAT FAILURE

Randall County: Big Bear Oil Co. 1 Currie, Sec. 57, Blk. 6, H&GN Survey, 9 miles southeast of Amarillo, dry, TD 6,149 ft.

SOUTHEAST NEW MEXICO

HOBBS.—Two new wildcat locations were announced last week for Eddy County.

Some 25 miles southwest of Artesia in 24-18s-23e, Southern Union Production Co. will drill 1 Elliott to 7,500 ft. The other is Malco Refineries, Inc., 1 Wills in 4-21s-24e, which will be carried to 3,750 ft. This test is an old well previously abandoned at 1,220 ft. Location is 20 miles west and slightly north of Carlsbad.

Wildcat drilling reports included Richland Oil Corp. 1 Mullis Unit, in 21-15s-29e, 20 miles east of Lake Arthur in Chaves County, shut down at 11,812 ft. with drill pipe stuck at that depth in the Ellenburger. Top on the formation was 11,760 ft. An Ellenburger test in the Monument-Eunice area of Lea County, American Petroleum Corp. 5 Phillips, in 1-20s-36e, was drilling ahead below 5,675 ft. A scheduled 8,000-ft. wildcat east of the Brunson field, Mid-Continent Petroleum Corp. 4 Lynch, in 1-22s-37e, was drilling below 5,000 ft. Tide Water Associated Oil Co. 1-D Marshall, in 13-21s-36e, two miles northeast of the Drinkard field in southeast Lea County, was drilling ahead after being shut down for repairs at 4,775 ft.

SOUTHEAST NEW MEXICO WILDCAT FAILURE

Lea County: Amerada Petroleum Corp. 1 State, SE SE 24-21s-33e, 6 mi. W Eunice field, dry, TD 6,370 ft., anhydrite 1,880 ft., base salt 3,735 ft., Yates 3,950 ft.

SOUTH LOUISIANA

New Pool Discovery in Avoyelles Parish

NEW ORLEANS.—Southwest Eola discovery, Atlantic Refining Co. 1 Haas Investment Co., Inc., 10-2s-2e, 1½ miles west of most southerly production in Eola field, Avoyelles Parish, made a potential flow of 186 bbl. of 44.7°-gravity pipe line oil daily through a 10/64-in. choke with a gas ratio of 1,015. Flowing pressure on the tubing was 1,000 psi. Total depth is 8,661 ft., and perforations from 8,562-72 ft. in the Wilcox sands for completion. Paleo tops by log are: Vicksburg 6,925 ft., Cockfield at 6,580 ft. with first Cockfield sand at 6,670 ft., Cook Mountain 7,220 ft. and first Wilcox sand at 8,375 ft.

The Texas Co. 1 Lafourche Basin Levee District, deep wildcat exploration in the Queen Bess Island area of Jefferson Parish, 1½ miles west of the 1 State gasser, and in Section 30-20s-25e, is preparing to make tests in record deep sands for South Louisiana. Hole bottoms at 15,523 ft., 5½-in. pipe is cemented at 13,996 ft., top of the cement at 13,920 ft. and a squeeze job has been made at 13,916-918 ft. Electric log has been run and operators are preparing for a production try.

A third well for the Holmwood pool of Calcasieu Parish is making a potential gage, and another good producer is assured, while a fourth test sets production pipe. The new producer is Sohio and Gulf 2 W. E. Walker et al, 26-10s-7w, total depth 10,600 ft., with 5½-in. production pipe cemented 1 ft. off bottom and perforations made in the discovery sands from 10,356-366 ft. The fourth well will be 2-B Farmers Land & Canal Co., also in Section 26-10s-7w. Total depth is 10,488 ft. and operators are going in the hole with 5½-in. pipe after running log and taking samples of sands.

Magnolia Petroleum Co. is driving piling for immediate operations in two new wildcat explorations out in the Gulf of Mexico off Terrebonne Parish shore on State Leases 791 and 766. Their 1 Ship Shoal Block 72, Lease 766, is 8 miles south of Coon Point and is to be a 13,500-ft. test using company tools. The 1 South Pelto Block 11, Lease 791, is 10 miles south of production in the Lake Pelto field, and is a shallow dome project scheduled to go to the 1,200-ft. level using company tools. Their 1 State Lease 684, Block 94, in the Eugene Island area of St. Mary Parish, 23 miles south-southwest of Rabbit Island field, and approximately 25 miles from the nearest point on the Louisiana coast, has been abandoned. Total depth is 2,613 ft. in salt, top of salt at 2,606 ft.

There were 13 new locations reported this week with 3 being wildcats, 1 in Plaquemines and 2 in Terrebonne parishes. One new oil pool was opened in Avoyelles Parish, Southwest Eola, by Atlantic Refining Co. Three dry wildcats were completed, one each in Plaquemines, St. Charles and St. Mary parishes.

SOUTH LOUISIANA SUCCESSFUL WILDCAT

Avoyelles Parish: New oil pool, Southwest Eola—Atlantic Refg. Co. 1 Haas Investment Co., Inc., 10-2s-2e, 1½ mi. W of most southerly production in Eola field, TD 8,661 ft., top sand 8,562 ft., Wilcox, perf. 8,562-72 ft., IP: 186 bbl. oil per day through a 10/64-in. choke, gas-oil ratio 1,015 cu. ft., TP 1,000 psi., gravity 44.7°, no water. Paleo tops: Vicksburg 6,925 ft., Cockfield 6,580 ft., 1st Cockfield sand 6,670 ft., Cook Mountain 7,220 ft., 1st Wilcox 8,375 ft.

SOUTH LOUISIANA WILDCAT FAILURES

Plaquemines Parish: The Texas Co. 1 Bradish-Johnson Co., Ltd., Magnolia Prospect wildcat, 19-18s-26e, 3 mi. WSW of Magnolia townsite, 4 mi. E of Lake Hermitage field, dry, TD 13,560 ft.

St. Charles Parish: Gulf Refg. Co. 23 Delta Sec. Co. Inc. Bayou Couba wildcat, 8-15s-22e, dry, TD 11,625 ft.

St. Mary Parish: Magnolia Pet. Co. 1 State, Lease 684, Blk. 94, 23 miles SSW of Rabbit Island field, dry, TD 2,613 ft., top salt 2,606 ft.

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ROCKY MOUNTAIN

Sinclair Hits in Northwest Elk Basin

DENVER. — Sinclair-Wyoming Oil Co. 1 Wilkins, NW SW NW 28-9s-23e, Northwest Elk Basin, Carbon County, Wyoming, found saturation in the Madison lime, and with shows in the upper horizons, definitely rates as an important discovery. The lime was topped at 6,225 ft., and showed saturation in the cores. A drill-stem test at 6,425-70 ft., open 20 minutes, resulted in a recovery of 600 ft. of 30°-gravity crude oil, and 200 ft. of oil and gas-cut mud. Flowing pressure at the end of the test was 600 psi., and bottom-hole pressure 2,400 psi. It is coring ahead at 6,590 ft.

The discovery is 2 miles northwest of 38-M Unit, the only well drilled to the Madison in the Elk Basin field proper. This well flowed 247 bbl. of 30.2°-gravity oil through a ⅜-in. choke in 24 hours from the lower part of the Madison at a total depth of 5,013 ft. after casing off approximately 340 ft. of pay sand in the upper section. It had the top of the Madison at 4,340 ft., elevation 4,503 ft.

The Wilkins well ground elevation is 4,470 ft., and opens a new pool as it has independent closure between Elk Basin proper and Northwest Elk Basin as a result of faulting. It topped the Tensleep at 5,912 ft., and a drill-stem test at 5,913-33 ft., open 20 minutes, recovered 4,500,000 cu. ft. of gas and 90 ft. of distillate. It previously had shown 3,500,000 cu. ft. of gas in 40 minutes in the Lakota; estimated 10,000,000 cu. ft. in the second bench of the Dakota; and 315 ft. of oil and 285 ft. of oil-cut mud with 775,000 cu. ft. of gas in the second Frontier sand.

Big well at Sand Draw.—Sinclair-Wyoming Oil Co. completed its 5 Unit, SW NE SW 14-32n-95w, at 7,996 ft., total depth, for 3,151 bbl. in 24 hours flowing through 1-in. choke on the 7-in., wide open, from the Tensleep sand, Big Sand Draw field, Fremont County, Wyoming. It is not only the largest well in the field, but marks an extension ¾ mile to the southeast. Top of the Tensleep was at 7,677 ft., and elevation is 6,221 ft. This is the first well drilled south of the discovery, which was completed late in 1944 and made 1,300 bbl. in 16 hours when put on the line in 1945. A north offset struck a fault and upon redrilling made 392 bbl. in 24 hours. No. 3 Unit, ½ mile to the northwest, flowed at the rate of 1,768 bbl., and 4 unit, ½ mile northwest of 3 Unit, flowed 1,683 bbl. A thick section of the Embar lime above the Tensleep also showed saturation. In a drill-stem test at 7,407-49 ft., 5 Unit made 2,348,000 cu. ft. of gas and had a recovery of 990 ft. of distillate in 1 hour and 40 minutes. All five wells were completed in the Tensleep. Average gravity is around 34 degrees.

Piceance Creek completion.—General Petroleum Corp. 68-5 Government, SE NW SE 5-2s-96w, Piceance Creek field, Rio Blanco County, Colorado, 35 miles southeast of Rangely, first of a series of three wells to be drilled, was completed at 3,100 ft. in the Wasatch formation of Tertiary age for 4,000,000 cu. ft. of gas per day. Interest in the operation dates back to 1929 when the discovery was completed, it being reputed the first large field in this country to be unitized, the original unit consisting of approximately 61,000 acres, 100 per cent of all interests being included. Federal permits stipulated no additional drilling was to take place for a specified time. In 1932 two additional wells were drilled by Magnolia Petroleum Co. Last year General Petroleum drilled a deep test to 12,019 ft., in upper Cretaceous, having reached the base of the Tertiary at 9,350 ft. It was plugged back to the Wasatch and completed for 4,350,000 cu. ft. of gas per day. The present drilling is reported to be exploration on the flanks for oil.

Mush Creek extended.—Morton Drilling Co. 1 Segwick, C NE NE 17-44n-63w, Mush Creek district, Weston County, on the eastern rim of the Powder River basin, will extend the producing area 1½ miles west. It set the 5½-in. on top of the Newcastle (Muddy) sand at 5,153 ft., and when plug was drilled it was reported to have flowed 25 bbl. an hour. It will drill a little deeper to the second bench before completing.

Garden Park well.—Lorado Oil & Gas Co. 1, SW 33-16s-70w, Garden Park District, Fremont County, Colorado, reported abandoned in granite at 460 ft. 2 weeks ago, has not been abandoned according to the operator. Instead, new contract has been signed to drill deeper. It was stated that it drilled 60 ft. of red beds, 340 ft. of lime, then a thin streak of granite wash and went back into a sand at 440 ft., believed to be the Harding.

Madison lime extension.—Union Oil Co. 2 McNamara Unit, SW SW 14-36n-5w, Cut Bank field, Montana, 3 miles north and 4 miles east of nearest Madison lime wells in that area, flowed 165 bbl. from Madison in the first 18 hours at a total depth of 2,915 ft. The 5½-in. was set at 2,905 ft. and perforated with 26 shots at 2,895-2,900 ft. It was then acidized with 1,000 gal. It had the Ellis at 2,673 ft., and the top of the Madison at 2,817 ft. A flow of 17,000,000 cu. ft. of gas was encountered at 2,867 ft. in the top of the Madison and was killed before running pipe. Texas Co. 1 Doorenbos, NE SE 25-36n-6w, 5 miles southwest of the

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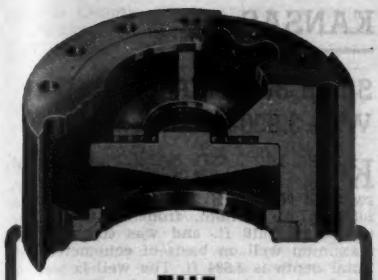

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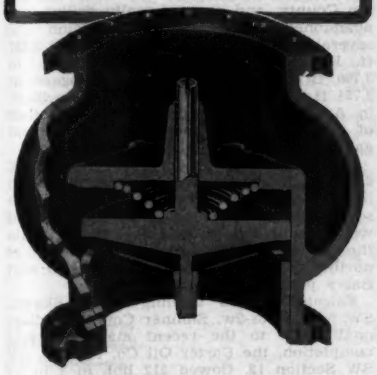

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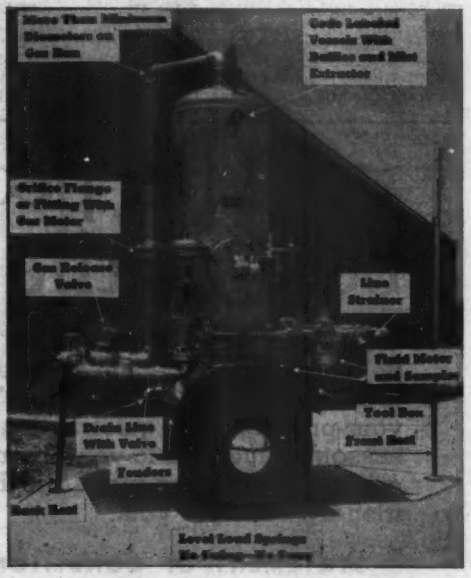
Rolo Wellcheckers are complete, mobile separators provided with orifice fittings, orifice meter, oil meter, automatic BS&W Sampler and all fittings and connections necessary for hooking direct into well. They gather and record potentials, gas/oil ratios, BS&W content and other vital well information on old producers . . . new wells . . . drill stem tests.

Wellcheckers are available as permanent or trailer-mounted units. Permanent units, mounted on skids for installation at batteries, permit wells to be tested individually through converging flow lines. Trailer-mounted units may be moved from location to location as requirements demand.



ALL VESSELS ARE CODE LABELED

CAPACITIES

Type	Max. Oil Bbls. Per Day	Max. Gas MCF	W.P. P.S.I.	Separator Size
ST	600	60	125	16" x 50" Vertical
JJ	500	1,000	125	24" x 56" Vertical
1	840	3,000	125	24" x 66" Vertical
2	504	3,000	125	24" x 66" Vertical
3	1704	3,000	125	24" x 66" Vertical
1H-3607	800	4,000	125	36" x 7' Horizontal
1H-3612	3000	12,000	125	36" x 12' Horizontal
5V-2456	750	6,000	500	24" x 66" Vertical
5V-3084	2200	8,500	500	30" x 8' 4" Vertical
5V-3011	3400	12,000	500	30" x 11' Vertical
5H-3607	1000	6,000	500	36" x 7' Horizontal
5H-3012	2500	10,000	500	30" x 12' Horizontal
5H-3016	4600	15,000	500	30" x 10' Horizontal

ROLO SPECIAL WELLCHECKER

This light-weight unit has a capacity of 600 barrels of fluid and 60,000 cubic feet of gas per day. Built-in gas valve prevents fluid spilling into gas line on wells making little or no gas. Weight complete, only 450 lbs.

ROLO MANUFACTURING COMPANY

2510 SOUTH BLVD. HOUSTON 6, TEXAS

Sales and Service Offices:
Kilgore, Texas: Rhea Brooks Co. Tulsa, Okla.: R. D. Eckstrand Co.
Export Office: R. S. Stokvis & Sons, Inc., New York, N. Y.

McNamara well, is being watched as a possible extension on the west side. It had the Madison at 3,150 ft., with a show of oil and gas, and is a near completion at 3,234 ft., total depth.

New operations.—Seventeen new operations were reported, of which 6 were in Colorado, 6 in Wyoming, 4 in Montana, and 1 in northwest New Mexico. Six were wildcats. Three of these in Colorado are promoted by local interests. These are as follows: Empire States Petroleum Co. 1 Ramsey, NW SW 27-4n-100w, Skull Creek district, Moffat County, a new Colorado corporation; L. & L. Drilling Co. 1 Government, NW SW 8-4n-98w, Elk Springs district, Moffat County 2¾ miles south of the Elk Springs discovery well; and Joe Dinger 1 fee, SW corner 35-2s-2e, Kannak Creek district, Mesa County. Two in Wyoming are A. B. Cobb & Co. 1 Maguire, NE NW SW 35-36n-65w, South Little Buck Creek, Niobrara County, east of the Lance Creek field and ¾ mile southwest of Little Buck Creek; and Conejos Corp. 1 Christiana, SE SW SE 33-45n-63w, Mush Creek district, Weston County, 2½ miles north of Sedgwick, now being completed as a west extension of the pool. The New Mexico wildcat is Florence Drilling Co. 1 Tribal, NE NE SW 23-32n-3w, on the Jicarilla Indian reservation, Rio Arriba County, just south of the Colorado boundary.

WILDCAT FAILURE IN WYOMING

Hidden Dome, Washakie County: Mackinnie Oil & Drilling Co. 1 Broome, SW SW SW 30-48n-90w, TD 5,206 ft., Embar 4,863 ft., Tensleep 5,100 ft. Temporarily suspended.

WILDCAT FAILURE IN MONTANA

East Laurel, Yellowstone County: Anton Kocher 1 Leach, SE SE 6-3s-25e, TD 1,105 ft., lost hole, plugged and abd., show of oil and water in Dakota at 949-973 ft.

The people behind the figures

The figures on the statement tell you how strong Republic is but it is the people behind the figures that make your bank friendly. The extra interest in your problems, the quick action on your wishes, the PERSONAL attention to your financial affairs . . . these are the things that make the Republic the strong, friendly bank for you.

STATEMENT OF CONDITION JUNE 30, 1947

RESOURCES

Cash and Due from Banks		$ 82,734,158.69
U. S. Government Securities		52,639,436.80
State, Municipal, and Other Securities		453,701.72
Stock in Federal Reserve Bank		600,000.00
Loans and Discounts		123,567,009.45
Banking House		2,205,128.43
Furniture and Fixtures		295,731.25
Real Estate for Bank Expansion		285,595.10
Customers Liability—Acceptances and Letters of Credit		659,009.67
TOTAL		$263,439,771.11

LIABILITIES

Capital	$ 10,000,000.00	
Surplus	10,000,000.00	$ 20,000,000.00
Undivided Profits		2,577,520.21
Reserve for Dividend, Payable July 1, 1947		200,000.00
Reserve for Taxes, Etc.		1,788,387.70
Acceptances and Letters of Credit		709,009.67
DEPOSITS:		
Individual	$165,232,646.45	
Banks	72,207,735.79	
U. S. Government	724,471.29	238,164,853.53
TOTAL		$263,439,771.11

REPUBLIC
NATIONAL BANK *of* DALLAS

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

KANSAS

South Burnett Pool Opened With 3,000-Bbl. Well

KEYES DRILLING CO. 1 Marshall, NW NW NW 25-11s-18w, Ellis County, swabbed 30 bbl. oil per hour for 4 hours, 2,000 ft. off bottom, from Arbuckle lime topped at 3,618 ft. and was completed as maximum well on basis of echometer test. Total depth is 3,624 ft. The well is west of the Bemis pool and about 1 mile south of the Burnett pool, and the new producing area will be designated the South Burnett pool.

Westgate-Greenland 1 Bartos, SE SE SE 15-9s-19w, Rooks County, swabbed 6 bbl. oil in 24 hours from Arbuckle lime topped at 3,559 ft. where pipe is set. The well which is 2¼ miles southwest of the Southeast Barry pool, will be acidized.

Bay Petroleum et al 1 Smith, NE NE 12-21s-16w, Pawnee County, has pipe set to test Arbuckle. The Smith well is 1½ miles southwest of the Ash Creek pool discovery well, located in NE SE SW 31-20s-15w, Barton County, and was originally drilled and abandoned by Magnolia Petroleum Co. several years ago at a total depth of 3,787 ft. Present operators drilled out hole to 3,790 ft. Top of Arbuckle was logged at 3,754 ft. Drill-stem test of zone 12 to 34 ft. in Arbuckle recovered estimated gas flow of 3,000,000 cu. ft. and 330 ft. of oil and gas-cut mud.

Continental Oil Co. 1 Gilbert, NE NE SE 6-9s-18w, Rooks County, swabbed 70 bbl. oil in 11 hours from Arbuckle lime. Pipe was set 2 ft. in the Arbuckle at 3,498 ft. and well was drilled to 3,497 ft., or 10 ft. into the Arbuckle. The well is about 1¼ miles northeast of production in the Southeast Barry pool.

Falcon-Seaboard Drilling Co. 2 Skaggs, SW NW 12-33s-2w, Sumner County, a diagonal offset to the recent maximum well completion, the Carter Oil Co. 1 Davis, NE SW Section 12, flowed 212 bbl. in 4 hours through ¼-in. choke with pipe set on top of Simpson at 4,241 ft. Total depth is 4,245 ft. This promises to be the third large well since the revival of activity in the Perth pool, which was precipitated by completion earlier in the year of Falcon-Seaboard 1 Skaggs SE NW Section 12, which was completed with a flowing potential of 1,578 bbl. oil per day. Falcon-Seaboard 3 Skaggs, NW NW Section 12, a north offset to 2 Skaggs, is drilling below 2,126 ft.

Barber County has three wildcats nearing completion. Bishop 1 Burns, NE NE NE 25-33s-11w, topped Lansing at 3,921 ft. and is drilling below 4,030 ft. Skelly Oil Co. 1 Alexander, SE SE SW 6-33s-12w, had Lansing at 3,939 ft. and is drilling below 3,975 ft. Champlin 1 Storm, NE SE NE 12-33s-14w, had Lansing at 4,214 ft., Mississippi at 4,716 ft., Viola at 5,039 ft. and is now drilling below 5,079 ft. Drill-stem test in top of Mississippi gave negative results.

About 8 miles east of the North Hilger pool, in the northeastern part of Sedgwick County, Continental Oil Co. et al have made location for 1 Hess in SE SE SE 24-25s-3w.

KANSAS SUCCESSFUL WILDCAT

Sedgwick County: Extension to Schulte (Abd.)—Aladdin Petroleum 1 Dugan, NW NW SE 7-28s-1w, produced 2,955 bbl. of 41.5°-gravity oil per day from Simpson at 3,659-63 ft.; Kansas City 2,776 ft., Mississippian 3,332 ft., Basal Mississippian 3,589 ft., TD 3,663 ft.

KANSAS WILDCAT FAILURES

Butler County: J. M. Huber and Dunne & Strait 1 Strait, SE SW SE 28-26s-6e, dry, TD 3,213 ft., Lansing 1,850 ft., Kansas City 2,143 ft., Basal Kansas City 2,540 ft., Mississippian 2,782 ft., Viola 3,211 ft.

Cowley County: McNeish & Gralapp 1 Doane, NE NE NW 36-33s-6e, dry, TD 2,800 ft., Mississippian 2,732 ft.

Edwards County: Skelly Oil Co. 1 Nellie Martin, NW SW NW 8-26s-16w, dry, TD 4,880 ft., anhydrite 1,052 ft., Topeka 3,418 ft., Lansing-Kansas City 3,972 ft., Mississippi lime 4,429 ft., Kinderhook shale 4,467 ft., Kinderhook sand 4,469 ft. with good stain and odor of oil, Viola 4,520 ft., Simpson shale 4,725 ft., Simpson sand 4,774 ft., Arbuckle 4,830 ft.

Ellsworth County: Bridgeport Oil Co. 1 Janda "G," C N/2 NW NW 28-15s-10w, dry, TD 3,350 ft., Lansing-Kansas City 2,930 ft., conglomerate 3,278 ft., Arbuckle 3,317 ft.

Graham County: Anderson-Prichard and Continental Oil 1 Klewer, SW SW NW 24-10s-21w, dry, TD 3,870 ft., anhydrite 1,655 ft., Lansing-Kansas City 3,472 ft., conglomerate 3,757 ft., Arbuckle 3,755 ft.

Reno County: Braden-Green Drilling 1 Goetzer, SW SW SW 12-22s-5w, dry, TD 3,991 ft., Lansing-Kansas City 2,675 ft., Mississippian 3,353 ft., Kinderhook 3,606 ft., Misener 3,724 ft., Hunton 3,736 ft., Sylvan 3,753 ft., Viola 3,868 ft., Simpson 3,887 ft., Arbuckle 3,961 ft.

Rooks County: Nate Appleman 1 Mathews, NW NW SW 29-7s-19w, dry, TD 3,471 ft., anhydrite 1,445 ft., Lansing-Kansas City 3,120 ft., conglomerate 3,387 ft., Arbuckle 3,400 ft.

Rush County: Stanolind Oil & Gas 1 Katy Budde, SE SE NW 2-19s-16w, dry, TD 3,663 ft., anhydrite 1,056 ft., Lansing-Kansas City 3,349 ft., Regan 3,642 ft., granite 3,661 ft.

Russell County: Musgrove Petroleum Corp. 1 Hoch, SW SW NE 24-15s-11w, dry, TD 3,390 ft., anhydrite 685 ft., Heebner 2,886 ft., brown lime 2,981 ft., Lansing-Kansas City 3,000 ft., Sooy 3,327 ft., Arbuckle 3,340 ft.

Wilson County: Mid-Continent Petroleum Corp. 1 Chester Eshbaugh, NW NE NW 12-27s-13e, dry, TD 1,866 ft., Mississippian 1,472 ft., Arbuckle 1,815 ft.

ILLINOIS

Sohio Testing Prospective Pool Opener in Gallatin

MATTOON.—Sohio Petroleum Co. 1 Lynch, NE NE NE 32-8s-10e, Gallatin County, had gas at the surface in 1 hour and recovered 2,390 ft. oil, 60 ft. oil-cut mud, and no water on drill-stem test at 2,740-90 ft. Lower Renault was logged at 2,730-55 ft. and Aux Vases at 2,757-88 ft. Total depth is 2,790 ft. Pipe is set at 2,733 ft.

Gilliam Drilling Co. et al 1 Bertha Ebe, NE NE NW 14-2n-4e, Marion County, is shut in for tankage after flowing and swabbing 685 bbl. oil on 14-hour test. Production the last hour of the test was 68 bbl. The pay zone is in St. Louis lime at 2,872-78 ft. Total depth is 2,884 ft. This pool-opener is about 12 miles east of the Salem pool.

Ben Taylor 1 Sebastian, NW NE SW 21-1n-2e, Marion County, swabbed 6 bbl. oil and 6 bbl. water natural from Benoist at 1,921-27 ft. The well was shot and is being cleaned out to test.

Gulf Oil Corp. 1 Bretz, SW SW SE 16-4n-4e, Marion County, recovered 240 ft. clean oil, 60 ft. mud-cut oil and 120 ft. drilling mud on drill-stem test at 2,139-49 ft. Tools are now below 2,175 ft.

Puritan Drilling Co. et al 1 Spicer, NW NW SW 24-1n-5e, Wayne County, had gas at surface in 55 minutes and recovered 2,000 ft. oil, 65 ft. mud, and no water on drill-stem test at 2,954-73 ft. in Aux Vases. Pipe is set at 2,947 ft.

ILLINOIS WILDCAT FAILURES

Edwards County: Don Barnes 1 Wilson, NW NW NW 2-2s-10e, dry at 2,912 ft., Hardinsburg 2,723 ft., Golconda 2,795 ft.

Gallatin County: C. E. Brehm 1 Woolcott, SE NW NE 31-7s-8e, dry at 2,979 ft., Glen Dean 2,185 ft., Benoist 2,611 ft., Ste. Genevieve 2,813 ft., McClosky 2,882 ft.

Jasper County: National Associated Oil Co. 1 C. Smith, NE NE NE 28-7n-9e, dry at 3,080 ft., Barlow 2,575 ft., Rosiclare 2,920 ft., St. Louis 3,073 ft.

Shelby County: Paul Doran 1 Durst, NW SE NW 34-11n-4e, dry at 1,870 ft., Glen Dean 1,526 ft., Golconda 1,572 ft., Cypress 1,666 ft., Renault 1,779 ft., Aux Vases 1,827 ft.

Washington County: Carter Oil Co. 1 H. D. Jack, NW NE NE 21-2s-2w, dry at 1,890 ft., Glen Dean 1,212 ft., Cypress 1,434 ft., Aux Vases 1,664 ft., Ste. Genevieve 1,732 ft., McClosky 1,794 ft.

Wayne County: Robinson-Puckett 1 B. Harris, SW NW NE 20-1s-8e, dry at 3,300 ft., Tar Springs 2,636 ft., Cypress 2,940 ft., Aux Vases 3,144 ft., Ste. Genevieve 3,204 ft.

White County: J. H. Gilliam 1 McKnight, NE NW SE 14-4s-10e, dry at 3,204 ft., Tar Springs 2,432 ft., Barlow 2,729 ft., Cypress 2,750 ft., McClosky 3,177 ft.

J. J. Lynn 1 Turner, SE NW NW 32-6s-9e, dry at 3,210 ft., Glen Dean 2,558 ft., Cypress 2,790 ft., Rosiclare 3,134 ft., Fredonia 3,168 ft.

OHIO, KENTUCKY

Frazier Pool Gets Big Gas Well

COLUMBUS.—The Ohio Fuel completed a large gas well on Russell Longshore, Section 15, in the south part of the new Frazier pool in Brush Creek Township, Muskingum County. Clinton sand was found at 3,717-50 ft. and gaged 2,894,000 cu. ft. natural. Three additional wells are now drilling in the pool, and others are expected to start soon.

John Morrow et al struck a big flow of gas in the top of the sand in their L. M. Henderson 2, Section 28, Madison Township,

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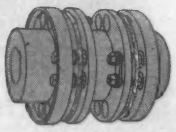
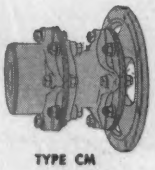
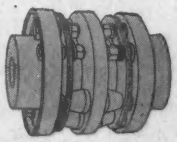

TYPE DBZ-C

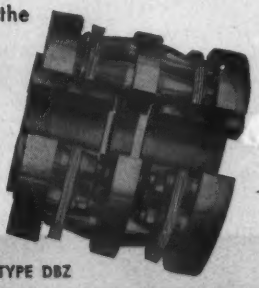
Pipe Line Men know that Thomas "Flexible" Couplings on their Low or High Speed Pumps give 100% dependable service.


TYPE CM

Drilling Engineers get the most out of their equipment with Thomas "Flexible" Couplings on Engine, Gear and Mud Pump Drives.


TYPE DBZ-S

In the Laboratory Thomas "Flexible" Dynamometer Couplings assure the greatest accuracy.


TYPE DBZ

Thomas Flexible All-Metal Couplings Have No Wearing Parts.
BACKLASH, FRICTION and CROSS-PULL ARE ELIMINATED.

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WARREN, PENNSYLVANIA

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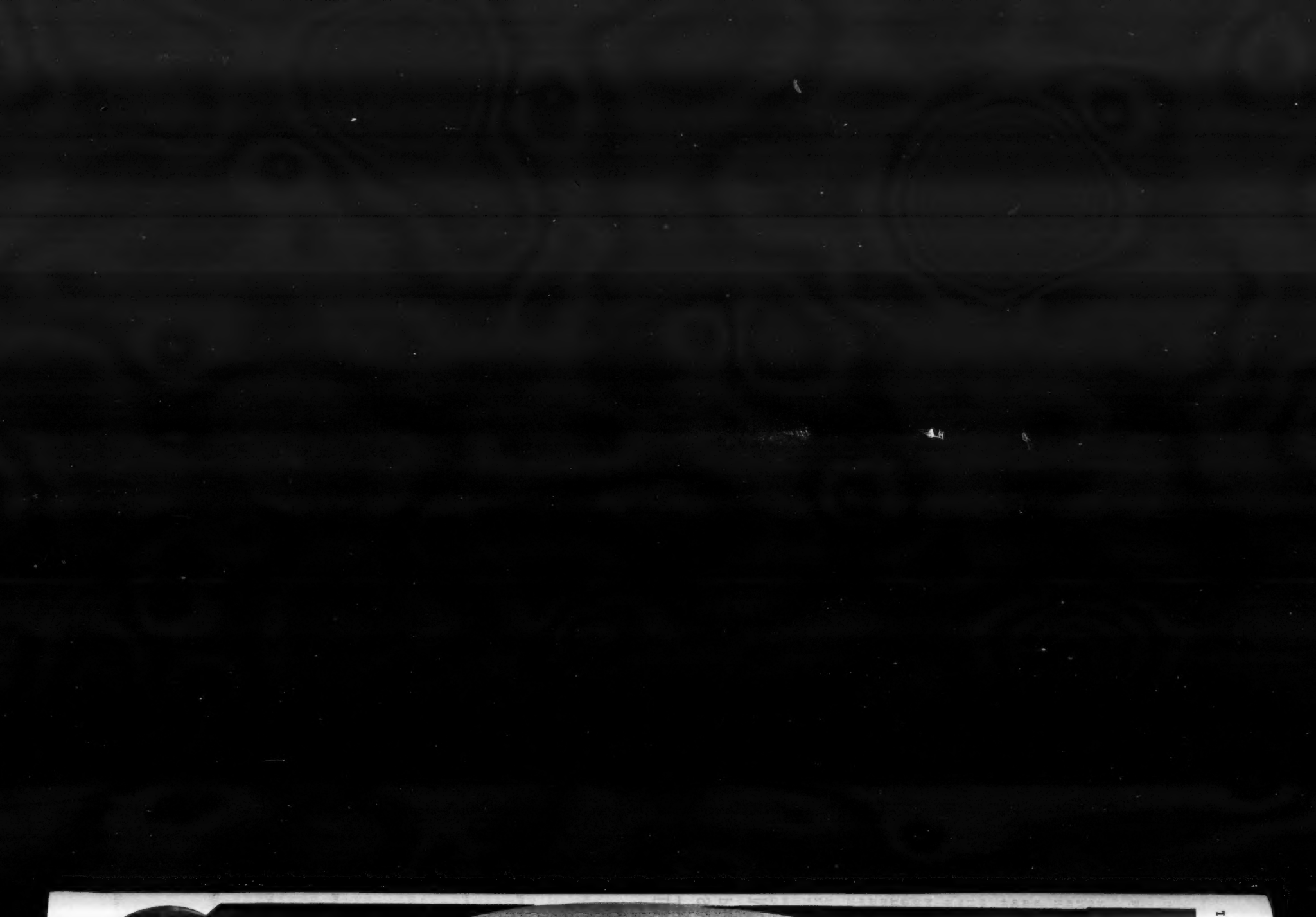


Perry County. The Clinton sand, topped at 3,265 ft., was drilled to 3,281 ft. where the gage was 2,000,000 cu. ft. The well is a west offset to an oil well on Charles Crossan, but it will not be drilled down to the oil pay until the head of gas is worked off.

The Medina sand in the Sayre pool in Bearfield Township, Perry County, is a consistant producer of gas. The Ohio Fuel 1 A. P. Alfman, Section 22, had only 103,000 cu. ft. in the Clinton sand at 3,798-3,838 ft., but when drilled 7 ft. into the Medina, the well had a gage of 944,000 cu. ft. The Medina sand was found at 3,911 ft., and as it may carry water in the bottom, the wells are drilled only a few feet in.

An 80-bbl. producer was completed in south part Hemlock Grove pool. The well was drilled by H. B. Walker on George E. Hauck, Section 2, Bedford Township, Meigs County. Berea sand at 1,5556-74 ft. was shot with 40 qt. and made 100,000 cu. ft. gas along with the oil.

Morgan County reported five locations for the week, reflecting increased activity in the area southeast of Crooksville. Stark County reported 3 locations and Knox, Perry, and Muskingum counties two each. Ashland field led in completions with 5 out of 22.

OHIO WILDCAT FAILURES

Lawrence County, Washington Township—Commonwealth Gas Corp. 49 Cambria Clay, Sec. 23, Clinton 2,814-27 ft., dry, TD 3,093 ft.

Logan County, McArthur Township: Ohio Oil 1 John Harrod, Lot 9,930, dry, Trenton 1,514 ft., St. Peter 2,027 ft., Mt. Simon 3,105 ft., Basement Complex 3,245 ft., TD 3,361 ft.

NOTICE OF SALE OF GAS FRANCHISE CITY OF HAZARD, KENTUCKY

Notice is hereby given that the City of Hazard, Ky., will, on Monday, July 28, 1947, at 7:30 o'clock P.M. at the City Hall in Hazard, Ky., offer for sale upon oral bids as at public auction a franchise granting the right and privilege to construct, lay, operate and maintain through, in, on and under the streets, side walks, alleys and public places of the City of Hazard, Ky., a system of pipe lines for the conveyance, distribution and sale of natural gas, artificial gas, either one or both of them, or a mixture of the two, for heating, lighting, manufacturing and power purposes, for the full term of 20 years from the date and time said franchise shall take effect. Said sale will be conducted by the City Manager or the Mayor of the City of Hazard, and any and all bids received will be reported at once to the Board of Commissioners of the City of Hazard, which board will thereupon consider same and either reject same or accept the best and highest bid.

All persons, firms and corporations desiring to bid for said franchise shall deposit with the City Manager of Hazard cash or a certified check equal to five percent (5%) of the fair estimated cost of the plant required to render the services called for by said franchise, which deposit shall be forfeited to the city in the case of any bid which is accepted, where the bidder fails for thirty days after the confirmation of the sale to pay the price bid, and to give a sufficient bond in a sum equal to ¼ of the fair estimated cost of the plant required and to be erected. Such bond will be conditioned to be enforceable in case the person, firm or corporation giving it fails within a reasonable time to establish a suitable plant for rendering service in the manner set forth in the terms of sale.

Upon the acceptance of a bid as the best and highest bid, the party or parties making and submitting same will be declared the purchaser or purchasers of the said franchise, and for the consideration set forth in said accepted bid, and said franchise will thereupon be sold, granted, conveyed and delivered to the purchaser or purchasers, their heirs, successors or assigns, subject, however, to the restrictions, terms, obligations and conditions set forth in an ordinance of the Board of Commissioners of the City of Hazard of June 9, 1947, a copy of which ordinance will be furnished to any prospective bidder upon request.

No person, firm or corporation will be entitled to bid on said franchise without having first complied with Section 278,020 Kentucky Revised Statutes, and who shall not have notified the City of Hazard prior to said sale of his or its compliance therewith.

This June 23, 1947.

WESTERN KENTUCKY

OWENSBORO.—Russel P. Johnson et al 1 Whitefield, 1-K-25, Hopkins County, is making 3½ bbl. oil and 3½ bbl. water per hour after 40-qt. shot in Tar Springs at 2,300-20 ft. Well was drilled to 2,967 ft. and plugged back to 2,325 ft. If commercial production is found, it will open a new area for exploration as nearest production is about 10 miles to the northeast in the Island pool.

C. R. Craft et al 1 Trigg Estate, 14-P-22, Henderson County, is drilling below 2,310 ft. In Madison County, Waller Chenault 1 Ginter, 12-P-65, is drilling below 1,698 ft.

WESTERN KENTUCKY WILDCAT FAILURES

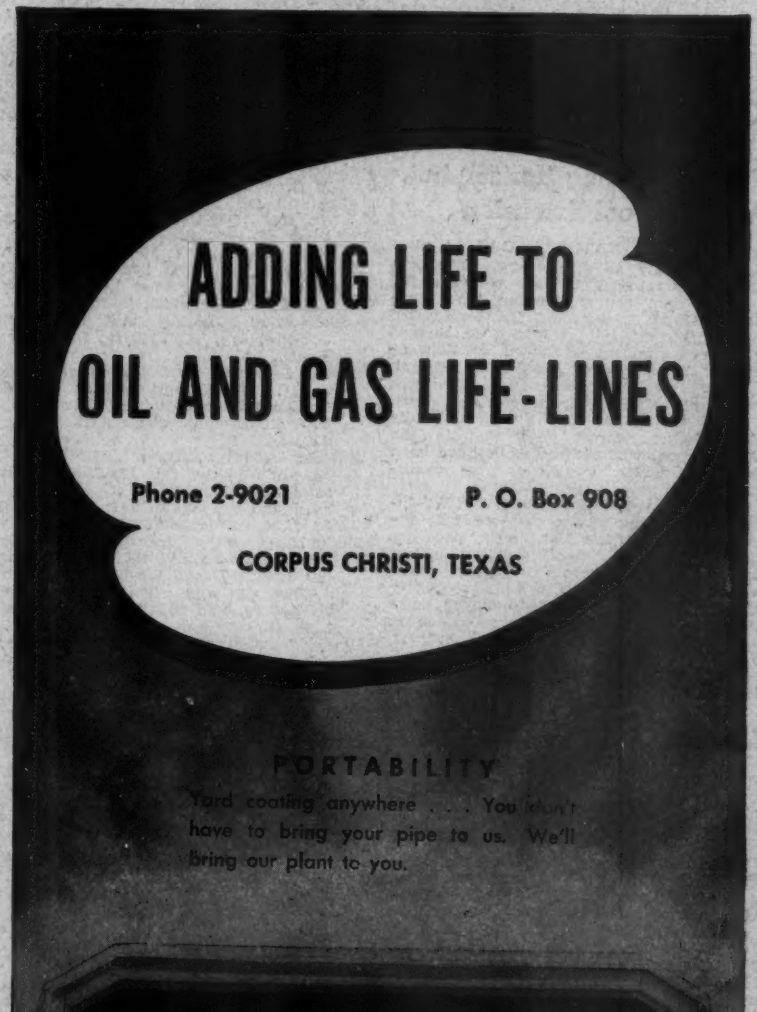
Henderson County: Carter Oil Co. 2 Sellers, NE NE SW 22-O-33, dry at 2,712 ft., Glen Dean 1,926 ft., Benoist 2,371 ft., Ste. Genevieve 2,504 ft., McClosky 2,513 ft.

R. Hal Compton 1 Mary Royster, 21-Q-25, dry at 2,286 ft., Tar Springs 1,530 ft., Golconda 1,756 ft., Aux Vases 2,037 ft., Ste. Genevieve 2,080 ft., McClosky 2,203 ft.

EASTERN KENTUCKY

ASHLAND.—Two completions were noted in eastern Kentucky during the week. The Kentucky-West Virginia Gas Co. completed well No. 85 on the H. H. Smith, et al., property, Knott County, at 2,912 ft., with 127,000 cu. ft. of gas in shale, after shot.

The same company completed well No.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573 on the Joseph Stewart property, Knott County, at 3,059 ft., with 110,000 cu. ft. of gas in shale, after shot.

INDIANA

EVANSVILLE.—Deep Vein Coal Co. 2 Davis, SW SW SE 6-2s-11w, Gibson County, swabbed and flowed 40 bbl. oil per hour from McClosky pay at 2,320-25 ft. Total depth is 2,325 ft. The well is about ¾ miles from small McClosky well in West Princeton pool.

Steve Zanetis 1 Gilliot, Survey 10, 8n-10w, Knox County, is pump-testing the Rosiclare pay at 1,871-91 ft. Total depth is 1,891 ft.

Princeton Mining Co. 1 McCarty, SE NW NE 13-2s-10w, Gibson County, is a 36-bbl. pumper from McClosky pay at 2,137-41 ft. and 2,744-47 ft., after treatment with 2,000 gal. acid.

INDIANA SUCCESSFUL WILDCAT

Gibson County: Princeton Mining Co. 1 McCarty, SE NW NE 13-2s-10w, IP 36 bbl., McClosky pay 2,137-41 ft.; 2,144-47 ft., TD 2,184 ft., 2,000 gal. acid.

OKLAHOMA

New Producing Horizon in Witcher Pool Extension

OKLAHOMA NATURAL GAS et al 1 Lair, SW SW 21-13n-2w, Oklahoma County, is reported to have recovered oil on drill-stem test in Hunton lime. Core from 6,129-37 ft. showed 7 ft. of saturated lime. Drill-stem test at 6,122-71 ft. showed gas in 2 minutes estimated at 6,200,000 cu. ft. When packer was pulled 25 gal. distillate were recovered. Bois d'Arc was logged at 6,125 ft. and Haragan at 6,140 ft. Total depth is 6,146 ft. The well is ½ mile east of the nearest production in the Witcher pool where three wells have been completed which produce gas or gas-distillate from lower Pennsylvanian.

Sinclair Prairie 1 Harrison, NW NW 6-4n-3w, Garvin County, the east offset to the discovery well of the East Lindsay pool, has been completed for a big well in the first and second Simpson sands. The well made a flowing potential of 1,547 bbl. 42°-gravity oil per day through 28/64-in. choke on a 12-hour test. First Simpson was logged at 9,785 ft. and second Simpson at 9,979 ft. Total depth is 10,050 ft. The discovery well of the East Lindsay pool produces from Hunton.

On the trend through Southwest Maysville and North Antioch, and about midway between these pools, Ledgerwood 1 Hope, NE NW SE 32-4n-2w, Garvin County, is a successful renewal operation. The test was originally drilled to 7,000 ft. and abandoned after operator was unable to swedge out collapsed pipe near bottom of the hole. Hole was plugged back to 6,248 ft. and pipe was set at 6,221 ft. to test Pennsylvanian sand. The well was given a flowing potential of 63 bbl. 20°-gravity oil per day.

Texas Co. 1 Carter, NW SW NE 25-17-2e, Lincoln County, flowed 322 bbl. oil and 600 bbl. water through perforations at 4,505-18 ft. in the top of Hunton. The well is near the Perkins pool which produces from two Hunton wells.

OKLAHOMA SUCCESSFUL WILDCATS

Major County: Extension to SE Ringwood—Superior Oil 1 E. E. Scott, NE NW SE 27-22n-10w, flowed 72 bbl. of 39.9°-gravity oil per day from Manning sand at 6,723-46 ft., through 10/64-in. tubing choke, Hogshooter 5,930 ft., lime 6,060 ft., Big lime 6,290 ft., Oswego 6,350 ft., Mississippi lime 7,000 ft., Hunton 7,705 ft., Wilcox 8,135 ft., TD 8,312 ft.

McClain County: Sinclair Prairie 1 Garrett, NW SW SE 13-5n-2w, pumped 18 bbl. of 41.7°-gravity oil per day from Hunton at 6,730-90 ft.; Basal Pennsylvanian-Woodford 6,715 ft., Sylvan 7,046 ft., Viola 7,174 ft., Bromide dense 7,552 ft., first sand 7,706 ft., second sand 7,944 ft., TD 7,962 ft.

Oklahoma County: Extension to Witcher—Peppers Refining 1 Parks, C SW NW 20-13n-2w, 68,000,000 cu. ft. of gas from 6,150-68 ft.; conglomerate 5,558 ft., Oswego 5,840 ft., Bartlesville 6,108-25 ft., TD 6,168 ft.

Payne County: Josaline Production 1 Pratt SE SE SE 29-19n-5e, 2,000,000 cu. ft. of gas; Hogshooter 2,255 ft., Layton 2,275-2,315 ft., Prue 3,070 ft., Mississippi lime 3,529 ft., dolomite 3,706 ft., Wilcox 3,715-20 ft., second Wilcox 3,733 ft., TD 3,802 ft.

Stephens County: Skelly et al 1 Woodmansee, NW NW NW 14-2s-4w, pumped 35 bbl. of 37.3°-gravity oil per day from sand at 3,982-4,080 ft., no other tops reported, TD 4,202 ft.

OKLAHOMA WILDCAT FAILURES

Cotton County: Cochran-Cain 1 Jones, NE NE NE 15-4s-10w, dry, TD 1,355 ft., no tops reported.

Morgan Brown 2 Rose, NW NW NW NE 25-4s-11w, dry, TD 1,505 ft., sand 1,000-07 ft., 1,075-93 ft. and 1,345-50 ft.

Choate 1 Bost, NW NW NW 23-3s-10w, dry, TD 2,495 ft., sand and shale 385-400 ft., sand 1,943-65 ft.

Snoddy 1 Allgood, NE NE SE 16-3s-12w, dry, TD 2,020 ft., Granite wash 1,445-78 ft.

Bridwell Oil 1 Sam At-Tah-Dick, NW SE NW 13-3s-12w, dry, TD 1,954 ft., Megargel 1,937 ft.

Nixon Petroleum 1 Menz, NE SE SW 35-4s-12w, dry, TD 1,883 ft., conglomerate 1,210-16 ft., sand 1,616-19 ft. and 1,632-35 ft., lime 1,651-54 ft.

Blair et al 1 Parkey "A," SE SE NW 5-5s-10w, dry, TD 1,953 ft., no tops reported.

Garvin County: Tom Potter et al 1 Bonner, C SW SW 16-2n-1w, dry, TD 6,502 ft., Basal Pennsylvanian 5,415 ft., Viola 5,700 ft., Bromide dense 6,165 ft., sand 6,370-6,435 ft.

Jefferson County: Chamblin 1 Folsom, NE NE NW 34-3s-4w, dry, TD 3,856 ft., limy sand 1,340 ft. with slight show of oil, sand and lime 3,034-50 ft., sand 3,095-3,115 ft., Arbuckle 3,800 ft.

McCurtain County: Edwards & McClendon 1-A Perry, SE SW SE 25-7s-26e, dry, TD 1,403 ft., sand 680-700 ft., 1,001 ft., 1,200-05 ft. with slight show of oil, 1,255-60 ft. with slight show of oil, and 1,390 ft.

Okfuskee County: Sadler and Texola Drilling 1 Canard, NW NW SW 33-10n-10e, dry, TD 3,915 ft., Wapanucka 3,199 ft., Cromwell 3,419 ft., Mayes 3,760 ft., Hunton 3,884 ft.

LEGAL

Sealed bids will be received by the Director of Public Service-Safety of the City of Lancaster, State of Ohio, at the office of said Director until twelve o'clock noon of the 31st day of July, 1947, for the sale of the following:

One complete unit direct connected Natural Gas Compressor.

(Description)

Superior 4 cycle gas fuel engine.
Size ..... 50 HP.
Serial ..... #45003
240 R. P. M.
Compressor size ..... 10½ X 16.

This unit is full automatic, with automatic shutoff for over heated water, also for stoppage of oil flow.

The unit is equipped with mechanical oilers for the engine and Compressor.

Each bid must contain the full name of every person or company interested in the same and be accompanied by a bond in the sum of $100.00 to the satisfaction of the Director or a certified check on some solvent bank as a guarantee if the bid is accepted. Should any bid be rejected such check will be forthwith returned to the bidder, and should any bid be accepted such check will be returned upon the execution of sale.

The right is reserved to reject any and all bids.

By order of the Director of Service-Safety.

D. L. GROVE,
Director of Public Service-Safety.

Petroleum Price Index Remains Low For May

Although showing a small rise for May, the wholesale price index of petroleum products remained well below that of all commodities, according to figures released by the Bureau of Labor Statistics.

The index number for petroleum and petroleum products was 86.8 in May as compared with 86.3 in April. The figure for all commodities was 145. The bureau uses the average prices of 1926 as basic index of 100.

Petroleum and products is one of the five commodities on the bureau's list of 51 which has an index below 100. The other four are rayon, silk, automobile tires and tubes, and crude rubber.

Signal Buys Production In Santa Maria Field

LOS ANGELES.—Signal Oil & Gas Co. has announced purchase of the production of A. N. Macrate & Sons in Santa Maria field, Santa Barbara County, California.

The property consists of one flowing well and 13 pumping wells on the Marion R. Rice and Anselmo Fernandez leases which together produce approximately 450 bbl. daily. Involved in the deal were 304 acres. Purchase price is said to have been about $500,000.

California To Continue Fight For Tidelands

LOS ANGELES.—Attorney General Fred N. Howser of California returned to Los Angeles July 16 after a trip to Washington to confer with federal government officials on the recent Supreme Court decision holding that California's submerged offshore land is the property of the federal Government. Howser stated that California will not give up its fight to retain the approximately 3,000-sq. mile area. A petition for rehearing will be filed with the Supreme Court immediately,, he added. *(For later news from Washington on this situation, see Watching Washington, page 165).*

C.C.A. to Discontinue Noncooperative Refunds

Consumers Cooperative Association will discontinue payment of patronage refunds to noncooperative patrons effective September 1.

The announcement indicated C.C.A. is giving up the statutory tax exemption provided for agricultural cooperatives that qualify under the internal-revenue code. The cooperative operates in Kansas, Oklahoma, Missouri, Utah, Colorado, Iowa, South Dakota, and Wyoming and has extensive oil properties.

Among the

Drilling Contractors

Michigan Cable Tool Drilling Firm Organized

Missaukee Drilling Co., a cable tool partnership, has been organized by Frank Sheets, Harry Crawford, and Bob Sole with offices at 215 East Wisconsin, Mount Pleasant. The company has two strings of tools. Sole formerly engaged in the drilling for himself and the other two partners operated as Crawford & Sheet.

Southwest Drilling Co. Formed in California

Southwest Drilling Co. is the name of a recently formed company which will do contract drilling in California. Directors of the company are Kent Allen, Charles A. Keskey, Roy A. Linn and Elbert J. Evans. Headquarters will be in Long Beach, and the temporary address is 1003 Heartwell Building. This new company has received a contract to drill the 5 Gray, 8-29s-28e, as an exploratory test for the Crestmont Oil Co. on the old Hope Oil Co. property in the Kern River area.

A. F. Knappenberger is the contractor for the Paul J. Steed and Warren Oil Co. 1-A Mathis, southwest corner, J. Nessmith Survey A-1562, Steed field, Jack County, North Texas.

Bell & Burden, Compton, Calif., will drill Continental Oil Co. 50-2 and 53-2 Grubb, San Miguelito field, California.

Three Michigan contractors are scheduled for early starts on wildcats. **Goll, Graves & Mechling**, Saginaw, are to drill the Whyte & Roush 1 Adolph LaLonde, NW NW SW 22-18n-4e, Arenac County. **Art Boling**, Mt. Pleasant, is scheduled for the H. E. Bell 1 F. A. Focht, NW NE NW 6-15n-5w, Isabella County. **Leonard Drilling Co.**, Mt. Pleasant, will drill the J. O. Mutch 1 H. T. Donahue and Tawas Land Development Co., SE SW SE 29-21n-4e.

Dunlap & Graham Drilling Co., Long Beach, is preparing to spud in at the 1 Newland, 12-6s-11w, in the West Newport area of Orange County, California. This wildcat is being drilled under contract for the Republic Operators, Inc.

K. L. Kellogg & Sons, Long Beach, are rigging up to begin drilling at the M-1 KCL, 27-11n-22w, an explora-

Crew of Baker & Taylor Drilling Co. on the Sun Oil Co. 2 Fred Jamison, Coke County, Texas. The men are: A. H. McGinley, Ralph Denton, Herbert Tucker, driller, Marvin Porter, and G. E. Porter

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WATER GAGE SET

For oil field, locomotive type and marine boilers. Water shows black — steam shows white; the water level is unmistakable. U-Bolt construction is strongest and simplest to service. Glass replaced by simply removing nuts on face of gage . . . unnecessary to work between gage and boiler. Conforms with A.S.M.E., Federal and State requirements when used for pressures specified by their respective codes.

This is one of the complete line of Penberthy gages that meet every liquid level gage requirement.

PENBERTHY INJECTOR CO.

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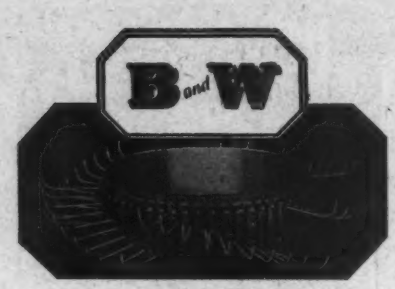

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DON'T SQUEEZE!

It Blocks Off Your Oil

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TYPE "C" CHEMICAL MEASURING **PUMP**

Extremely Accurate

DEPENDABLE

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Standard of the Oil Fields

McCORD

CORPORATION, DETROIT 11, MICH.

tory venture by the Continental Oil Co. in the San Emigdio area of Kern County, California.

Sterling Drilling Co., Sterling, Kans., is drilling a wildcat 1 mile south of Boyd pool, Barton County, Kansas. The test is the 1 Keener, SW SW SW 9-18-14.

Homer Fulton is the contractor for a wildcat, the H. M. McClure 1 W. Secord, NE SE SE 36-12n-3w, Gratiot County, Michigan.

Gene Reid Drilling Co., Bakersfield, has received contract to drill wells Nos. 31 and 32 for the Victory Oil Co. in the Cymric field of Kern County, California. Both wells will be located in 26-29s-21e.

Parker Drilling Co., Tulsa, is the contractor for Gulf Oil Corp. 1 Lorimer, C SE SW 36-31-20, northwest part of Comanche County, Kansas. This well is a rank wildcat 11 miles southwest of the Alford gas pool.

E. M. Shields, Butler, Pa., has received the contract to drill Gaspe Oil Ventures, Ltd. 2 Venture in the Gaspe Peninsula, Canada. Equipment is now en route. Location will be approximately 2,600 ft. south-southeast of Venture 1, which encountered small shows of high grade crude in a limestone formation.

McClure Drilling Co., Alma, Mich., is planning a test, its 1 Leo T. Fox, SE SW SW 23-8n-5w, Ionia County, Michigan.

Brokers Drilling Co., Bakersfield, is drilling the 1 Brokers as a shallow test at Kern River, Calif. Located in 8-29s-28e, the well is drilling currently at a depth of 10 ft.

E. M. Shields has contracted for a test, the Socony-Vacuum Oil Co., Inc., 1 C. L. Johnson, NE NE SE 8-9n-11w, Kent County, Michigan.

Beardmore Drilling Co., Wichita, and Barbara Oil Co. are to drill 1 Zern, SW NW SW 18-16-12, Barton County, Kansas, a wildcat 2 miles west of Beaver pool.

Hayes & Sprague Drilling Co. is reported preparing to test at the Seaboard Oil Co. 1 Johnson, 17-3s-14w, wildcat in the Lawndale area of Los Angeles County, California. Present depth of the well is 8,020 ft.

Hackathorn Drilling Co. has made location for 1 Ashing Ranch, C SW SW 11-45n-8w, in the Ridgeway area, Ouray County, Colorado.

Keyes Drilling Co., Ellinwood, is starting its 1 Tobias, SE SE SE 26-20-7, 1 mile north of North Wherry pool, Rice County, Kansas. Keyes

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Simple-Certain

Increase Boiler Efficiency

The Sand-Banum Way is so simple—so safe—so certain. One application a week of only a few ounces automatically and safely keeps boilers free of scale and corrosion.

Comes ready to use as is. Needs no special equipment, mixing or expert handling. All active ingredients—saves water analyses—reduces operating and maintenance costs.

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for a test under your regular operating conditions. If not entirely pleased with results, you will owe us nothing. Guaranteed harmless to personnel and equipment.

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"The Entirely Different Boiler and Engine Treatment"

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STANDCO BRAKE LINING

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Drop-Forged • Malleable Iron • Steel

Drop-Forged • Heat Treated • 2 Sizes

Durbin-Boomer F-1—2 swivels, ⅜, ½ or ⅝" chain
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- Drilling Cables
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Longer Life For Tool Joints
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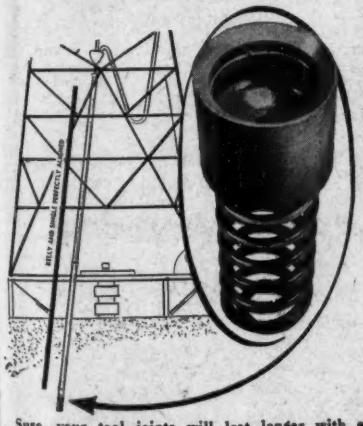
Ratcliff "Joint Aids" Keep Kelly and Single in Alignment While Connections Are Made



Sure, your tool joints will last longer with a "Joint Aid" in the mouse-hole . . . Kelly and single are spun up easily and quickly . . . in perfect alignment . . . *galling due to misaligned joints is completely eliminated.* You save time . . . you save wear and tear on tool joint threads . . . *you'll save the cost of a "Joint Aid" on the prevention of one galled tool joint.*

Inquire about them . . . they're made for all sizes of pipe and tubing, for any size mouse-hole. No alterations are required in the standard mouse-hole.

OWEN TOOL COMPANY
Route 9, Box 800-B Telephone V 2-4341
HOUSTON, TEXAS

Drilling and Tom Allan opened the North Wherry in April with a 67-bbl. well.

Bell & Burden, Inc., have moved to new offices in the Chester Williams Building, 215 West Fifth Street, Los Angeles.

Transit Corp. is rigging up for a wildcat, the Anderson-Prichard Oil Corp. and Texon Oil & Land Co. 1 Loyd, NW NW SW 33-9-22, 9 miles southwest of Morel pool, Graham County, Kansas. Transit is also drilling a Barton County wildcat for Stanolind Oil & Gas Co., the 1 Baker "B," NW SW NE 19-20-14, ¾ mile northwest of Dundee gas pool and 1 mile east of Unruh pool.

Regent Drilling Co., Calgary, Alta., has spudded Decalta Oils, Ltd. 1, LSD 2, 27-63-23w4, in the Perryvale area of northern Alberta.

Arrow Drilling Co., Tulsa, has filed intention to drill its 1 C. M. McGee, SE NE NE 20-17n-3e, Lincoln County, Oklahoma.

Contractors are drilling 9 of the 25 wells which Standard Oil Co. of California has under way at present. **Rocky Mountain Drilling Co.** has three contracts; **Stansbury, Inc.,** three, and **Brown Drilling Co., Thomas P. Pike Drilling Co.,** and **Trico Oil & Gas Co.,** one apiece.

Falcon-Seaboard Drilling Co., Tulsa, has filed intention to drill its 1 Klingsmith, NW NE SE 19-8n-2e, Pottawatomie County, Oklahoma.

Charles Mills, Lloydminster, Sask., has received the contract to drill Continental Oil Co. 1 Leduc in the Leduc field, Canada. Equipment is being moved to location in LSD 9, 33-49-26w4.

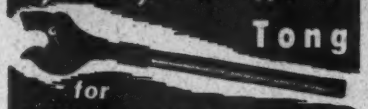
Amick Drilling Co. has made two more locations on the Mosser Dome structure southwest of Billings, Mont. The firm has already brought in two producers on the structure. The 1 Kelly was completed for 75 bbl. of oil daily at 1,011 ft. and the 1 Mosser swabbed 5 bbl. per hour at 1,015 ft. in its initial test.

Buffalo Drilling Co. is drilling ahead on its 1 Frank Doerner, NW SE SE 12-7s-8e, White County, Illinois.

Philco Drilling Co. has been listed as dissolved by the Oklahoma secretary of state.

Mealy-Wolfe Drilling Co., Tulsa, J. J. Deaner et al are moving in tools for a wildcat, the 1 Shannon, NE SE NW 33-15n-7e, between East Stroud and Big Pond pools, southwestern Creek County, Oklahoma. Contract is for a 4,100-ft. Wilcox test.

The Multi-range *lightweight* BJ Type "T" Tong for Drilling or Production Rigs



Designed to lighten and speed up the job of running tubing, BJ type "T" tongs are equally valuable in "nippling up" or as lay tongs. Made in five series: A, B, C, D, and E, with available jaws in each series to handle API tubing and coupling sizes from 1" to 4", plain or upset.

Change in size of tong jaws can be made quickly and easily. The dies are self sharpening and provide a quick, positive, non-crushing grip. The handle is made of reinforced seamless tubing, and is designed to provide sturdy, balanced construction. Stabbed on, these tongs cannot come open even if hinge pin fails, yet jaws easily release by pulling back on the sleeve. Call your BJ supplier and let him equip your rigs with "T" tongs.

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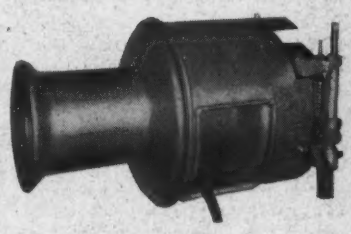
KELCO MODEL 14-DH SPINNING LINE CATHEAD



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- Adjustable During Operation
- Simplified Installation
- Available with Hydraulic or Mechanical Controls
- Unit Completely Enclosed to Prevent Line Fouling.

KELCO BEN F. KELLEY CO.
TULSA OKLAHOMA

STATISTICS and T

WEEKLY WELL COMPLETIONS . . . WEEK ENDED JULY 19, 1947

	Total of all wells							Wildcat completions and discoveries									
						Cum.							Cumulative total, 1947				
	Comp.	Oil	Gas	Dry	Footage	1947	1946	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
New York	39	20	0	*19	51,502	806	866	0	0	0	0	0	3	0	0	2	5
Pennsylvania	67	36	7	†24	95,977	1,529	2,202	0	0	0	0	0	0	0	0	1	1
West Virginia	20	3	14	3	50,455	442	381	0	0	2	1	3	0	0	3	1	4
Ohio	22	10	5	4	50,969	688	652	0	0	0	2	2	0	0	3	29	32
Indiana	18	8	2	8	28,513	335	186	2	0	0	0	2	12	0	0	24	36
Kentucky	16	11	2	3	29,612	343	256	0	0	0	2	2	6	0	0	27	33
Illinois	45	21	0	24	117,018	1,051	1,187	0	0	0	8	8	36	0	1	186	223
Michigan	26	10	6	10	56,068	420	438	0	0	1	7	8	5	0	9	113	127
Kansas	41	19	2	‡20	138,303	1,352	1,074	0	0	0	9	9	19	0	10	180	209
Neb., Mo., Iowa	0	0	0	0	0	2	9	0	0	0	0	0	0	0	0	2	2
Oklahoma	75	41	7	27	222,252	2,160	1,356	3	0	2	11	16	48	3	8	§361	420
Texas	197	122	8	67	848,258	4,737	4,394	7	1	1	29	38	160	28	48	711	947
North Central (Dist. 7-B & 9)	77	41	0	36	201,421	1,515	1,587	2	0	0	8	10	56	0	7	238	301
West (Dist. 7-C & 8)	40	32	0	8	209,592	1,127	919	1	0	0	5	6	16	0	3	84	103
Panhandle (Dist. 10)	10	3	4	3	33,202	231	186	0	0	0	1	1	1	0	1	4	6
Eastern (Dist. 5 & 6)	13	5	2	6	78,009	270	393	0	0	0	5	5	4	0	3	59	66
Gulf Coast (Dist. 3)	22	15	0	7	127,406	835	977	3	1	0	6	10	41	21	19	148	229
Southwest (Dist. 1, 2 & 4)	35	26	2	7	198,626	750	332	1	0	1	4	6	42	7	15	178	242
Louisiana	38	22	4	12	194,940	717	715	2	0	0	6	8	20	12	9	100	141
Northern	23	11	4	8	65,802	378	390	1	0	0	3	4	2	1	3	54	60
Southern	15	11	0	4	129,138	339	325	1	0	0	3	4	18	11	6	46	81
Arkansas	5	1	0	4	31,020	140	100	0	0	0	1	1	1	0	0	27	28
Mississippi	11	8	0	3	96,232	255	146	0	0	0	2	2	0	0	1	51	52
Southeastern States	0	0	0	0	0	25	25	0	0	0	0	0	0	0	0	22	22
Montana	9	7	0	2	21,237	125	159	0	0	0	1	1	2	0	1	13	16
Wyoming	5	4	0	1	25,701	112	93	0	0	0	1	1	7	0	2	18	27
Colorado-Utah	4	3	1	0	22,259	101	74	0	0	0	0	0	1	0	1	23	25
New Mexico	3	0	1	2	15,386	272	197	0	0	0	1	1	4	0	1	20	25
California	39	34	0	5	197,872	1,082	997	0	0	0	4	4	29	0	5	158	192
Total United States	680	380	62	238	2,293,574	16,694	15,507	14	1	6	85	106	353	43	102	2,069	2,567
Total previous week	673	369	60	224	2,431,349	16,014	14,931	13	1	3	78	95	339	42	96	§1,984	2,461
Total July 20, 1946	576	284	80	212	2,048,384			4	0	3	75	82	274	23	67	1,788	2,152

Service wells included: *19, †23, ‡2. §Revised.

CRUDE PRICES AND REFINERY ACTIVITY

GRAVITY SCHEDULES

Top prices include all gravities above grades designated, and low prices include all gravities below grades designated:

Gravity—	Signal Hill, Calif.*	Oklahoma, Kansas	Gulf Coast Tex.†	West Tex.‡
18-18.9	$1.60	....	....	....
19-19.9	1.65	....	....	....
20-20.9	1.69	$1.55	....	$1.42
21-21.9	1.73	1.57	....	1.44
22-22.9	1.77	1.59	....	1.46
23-23.9	1.80	1.61	....	1.48
24-24.9	1.84	1.63	$1.86	1.50
25-25.9	1.88	1.65	1.88	1.52
26-26.9	1.91	1.67	1.90	1.54
27-27.9	1.95	1.69	1.92	1.56
28-28.9	1.99	1.71	1.94	1.58
29-29.9	2.02	1.73	1.96	1.60
30-30.9	2.06	1.75	1.98	1.62
31-31.9	....	1.77	2.00	1.64
32-32.9	....	1.79	2.02	1.66
33-33.9	....	1.81	2.04	1.68
34-34.9	....	1.83	2.06	1.70
35-35.9	....	1.85	2.08	1.72
36-36.9	....	1.87	2.10	1.74
37-37.9	....	1.89	2.12	1.76
38-38.9	....	1.91	2.14	1.78
39-39.9	....	1.93	2.16	1.80
40 and above	....	1.95	2.18	1.82

*Standard Oil Co. of Calif. posting. †For crude from Daboval, El Campo, and Sandy Point. ‡Includes Lea County, New Mexico.

A.P.I. REFINERY REPORT, WEEK ENDED JULY 12

District—	Crude runs, daily avg.	(Thousands of barrels) Production: Gasoline†	Kerosine	Gas & dist. oil	Residual	Stocks at refineries, bulk terminals, in transit and in pipe lines: Gasoline*	Kerosine	Gas & dist. oil	Residual
East Coast	907	2,261	346	1,173	1,729	20,709	7,202	12,956	9,522
Appalachian:									
District 1	98	276	40	88	92	2,191	279	456	260
District 2	71	251	34	47	146	930	154	158	128
Ind., Ill., Ky.	797	2,890	296	813	1,046	15,916	1,837	4,517	3,681
Okla., Kans., Mo.	421	1,525	223	424	482	7,576	811	2,084	1,200
Inland Texas	247	1,005	109	111	474	3,402	390	406	765
Texas Gulf Coast	1,255	3,907	723	1,623	1,681	13,706	2,495	7,543	5,813
La. Gulf Coast	424	1,133	313	502	537	4,287	1,653	2,630	1,511
N. La. and Ark.	65	171	51	61	96	1,708	315	381	142
Rocky Mountain:									
New Mexico	9	39	3	10	19	87	10	39	38
Other Rocky Mtn.	131	389	19	153	213	2,844	124	689	655
California	804	2,260	37	904	2,164	15,435	787	13,402	26,814
July 12, 1947	5,229	16,197	2,194	5,909	8,679	86,791	16,057	45,261	50,529
July 5, 1947	5,109	15,759	1,963	5,659	8,485	89,674	14,857	43,000	49,151
July 13, 1946	4,866	14,942	1,950	5,452	8,246	90,807	15,315	42,652	48,252

*Finished and unfinished. †At refineries including natural blended.

Bureau of Mines crude-oil stocks 232,361,000 bbl. as of July 12—down 1,499,000 bbl. One year ago 222,377,000 bbl.

FLAT CRUDE PRICES

Representative posted schedules per bbl.			
East Texas	$1.95	Illinois Basin	2.07
Kettleman Hills, California*	2.14	Pecos County, Texas (Yates)	1.65
Beauregard Parish	1.90	Bradford, Pennsylvania	4.30
		Eastern Ill. and Western Ind.†	2.07
		Tomball, Texas Gulf Coast	2.10

*37°-37.9°. †35° and above.

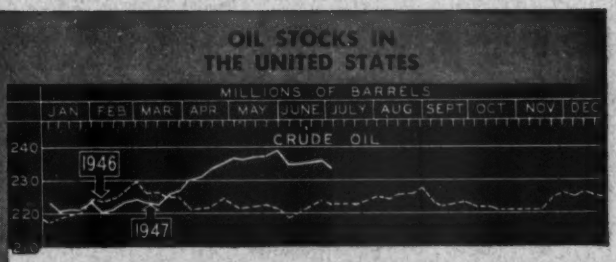
TRENDS

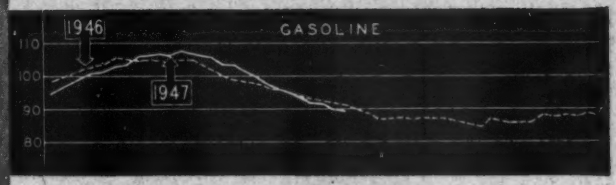
DAILY AVERAGE PRODUCTION FOR WEEK

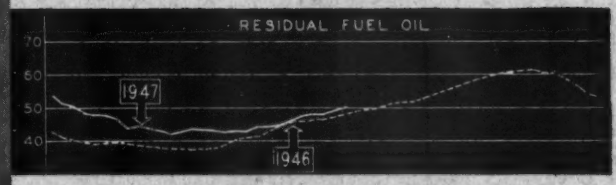
	July 19 crude oil	B. of M. July demand	July 12 crude oil
Alabama	1,100	1,200	1,200
Arkansas	81,050	80,000	80,750
California	918,000	900,000	918,750
Colorado	41,570	42,000	42,240
Eastern	62,800	65,400	63,600
Florida	1,000	600	975
Illinois	181,500	208,000	178,000
Indiana	17,600	18,000	17,900
Kansas	294,750	290,000	285,750
Kentucky	25,900	28,000	25,900
Louisiana	421,850	425,000	421,250
North Louisiana	97,300	.....	96,700
South Louisiana	324,550	.....	324,550
Michigan	57,360	45,000	54,025
Mississippi	95,860	90,000	97,310
Montana	23,160	24,000	22,520
Nebraska	550	600	550
New Mexico	108,150	104,000	108,150
Oklahoma	388,100	390,000	387,900
Texas	2,224,050	2,190,000	2,224,050
Dist. 1 (Southwest)	22,390	.....	22,390
Dist. 2 (Southwest)	163,360	.....	163,360
Dist. 4 (Southwest)	241,625	.....	241,625
Dist. 3 (Gulf Coast)	479,675	.....	479,675
Dist. 5 (Eastern)	39,155	.....	39,155
Dist. 6 (Eastern)	113,400	.....	113,400
East Texas Field	324,000	.....	324,000
Dist. 7-C (West)	38,840	.....	38,840
Dist. 8 (West)	555,250	.....	555,250
Dist. 7-B (W. Central)	37,075	.....	37,075
Dist. 9 (N. Central)	125,500	.....	125,500
Dist. 10 (Panhandle)	83,780	.....	83,780
Wyoming	114,070	118,000	113,350
Miscellaneous	.....	200	.....
Total United States	*5,058,420	5,020,000	5,044,170
Change from prev. wk., up	14,250		

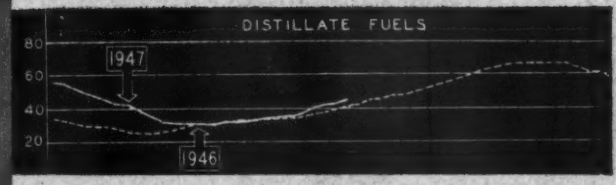
Total production January 1-July 19..... †986,719,910 bbl.
Same period last year (crude plus cond.).. 940,674,620 bbl.

*Not incl. 31,050 bbl. condensate. †Incl. 5,790,920 bbl. condensate.

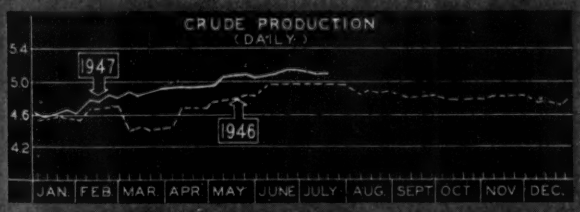


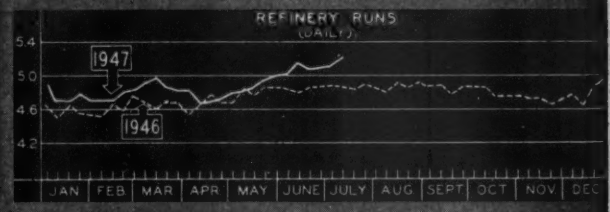




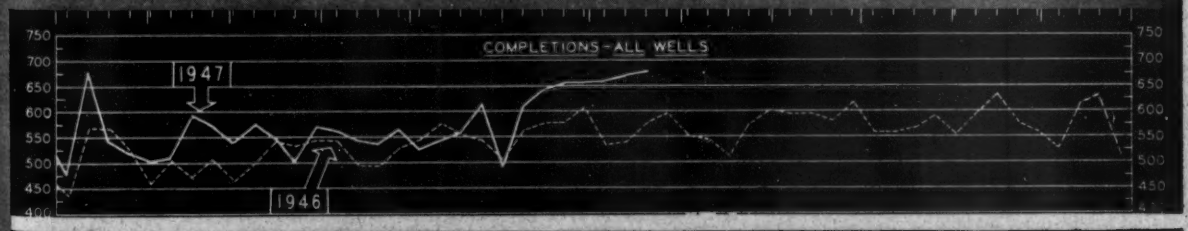


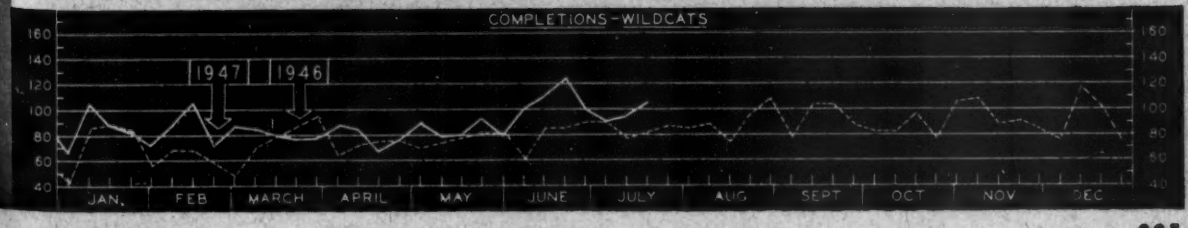
DAILY OPERATIONS





Solid line charts weekly completions, service wells in Eastern area included.





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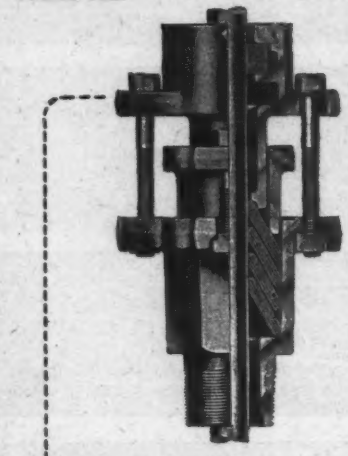
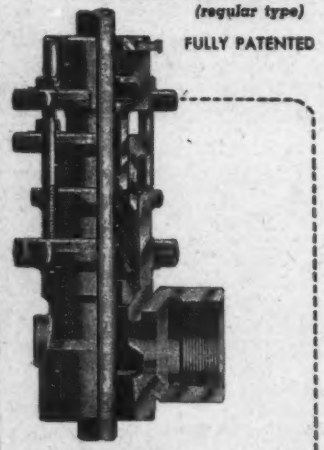
When the going is toughest, Operators turn to Hercules . . . it has been tested and accepted in every oil producing field as Standard. Hercules "Cone Packing" has successfully withstood over 2000 pounds pressure . . . has cut packing costs 75% and more in many instances . . . eliminates wabblers . . . is automatically lubricated . . . won't burn out if well pumps off . . . protects polish rod against excessive wear . . . is easy to install and is moderate in price. Next time . . . "Ask for the Cone Packed Box."



STUFFING BOX
(regular type)

FULLY PATENTED



STUFFING BOX-TEE
(T-base type)

Sold at all supply stores.

HERCULES TOOL COMPANY

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MARKETS

THE spot market for many petroleum products remained "dried up" this week in the Mid-Continent area. Scarcity of other products resulted in widely varying price reports with too few sales to determine the going market.

Major companies were reported offering 8¾ cents for regular gasoline, with others offering 9 cents for the same product, with no material moving. Refiners reported gasoline going only to regular accounts, regardless of price offerings.

No. 2 fuel oil was reported unavailable, following action of many purchasers in buying up in recent weeks all that could be used as diesel fuel at prices ranging about ⅜ cent above the regular price for No. 2. Kerosine was reported tight, with little available, and that at above-market prices.

Market observers reported "$2.50 heavy fuel oil" as being "all gone" with a current top between $2.30 and $2.40. Little of the material, however, was available.

Bunker C High

On the Gulf Coast refiners predicted there would be practically no spot-market movement of products until the end of August. What little material was available was moving at unusually high prices. One supplier reported a cargo of Bunker C moved at $2.60, highest price reported for the heavy fuel.

Gasoline was practically unobtainable, with nearly everything committed for some time ahead. One sale of 70-72 octane to the Government was reported to have been transacted at a 10-cent price. One shipment of Pool 21, a diesel oil, was reported at 7⅝ cents.

The Gulf Coast lubricating-oil situation was reported easing up a little as buyers, who a few weeks ago were taking everything offered, last week again were requiring products to meet specifications. Prices were unchanged.

In New York Harbor suppliers were divided on action to meet Socony-Vacuum Oil Co., Inc.'s, ½-cent advance on gasoline, diesel, and light burning oils, but the increase showed signs of spreading along the entire Eastern Seaboard.

Spot Market Quiet

Price structure of gasoline, No. 2, and kerosine at barge level in the harbor were almost evenly split between those suppliers quoting the new higher prices and those the old. Meanwhile, spot sales were practically at a standstill as many suppliers held their stocks closely in view of the price changes. Residual fuel-oil prices remained virtually unchanged along the Eastern Seaboard.

In Mexico, Petroleos Mexicanos, government oil agency, again raised the price of Bunker C fuel oil at Tampico, Veracruz, and Minatitlan, this time to $1.83 a barrel plus 1.65 per cent United States currency revenue stamps. At Guaymas, Manzanillo, and Salina Cruz the price was increased to $2.36.

In Washington, the Federal Supply Bureau of the Treasury Department reported six major oil companies in the East and one in the Midwest have made verbal commitments to supply additional specific fuel-oil items for the New England area in the immediate future. Officials indicated the commitments resulted from activity of the National Petroleum Council.

Standard Oil Co. (Ohio) has announced a plan for allocating gasoline and kerosine supplies.

Representative Quotations

Representative spot-market quotations of leading suppliers as of July 21, 1947. Figures are f.o.b. plant for tank-car shipment in cents per gallon, except for residual fuel oil which shows the price per barrel and wax, in cents per pound.

GASOLINE, KEROSINE, AND FUEL OILS

	Mid-Continent Group 3	New York Harbor	Texas Gulf Coast
Regular gasoline, 73-75 octane	8-8.75	10.1-10.4* 9.3-9.5†	8.5-9.5
Premium gasoline, 78-80 octane	8.75-9.75	10.2-12	9-9.5
42-44 w.w. kerosine	7.125-7.375	7.8	7-7.25
No. 2 straw fuel oil	6.25-7	6.8-7.1	6-6.5
No. 6 residual	$2.15-2.35	$2.32-2.50	$1.90-2.60

*Branded (74-76 octane); †Unbranded (74-76 octane).

NATURAL GASOLINE

	Group 3	North Texas	N. La.
Grade 26-70	5.875	5.375	5.625
Grade 18-55	7.05	6.45	6.75

LUBRICATING OILS

South Texas

200 vis., No. 2-3 neutral	11.5-12.5
750 vis., No. 3-4 neutral	13.5-15.25
2,000 No. 5-6 neutral	15-16.75

LUBRICATING OILS

Mid-Continent

150-160 vis. D bright stock, 0-10 p.p.	29
200 vis. No. 3 neutral, 0-10 p.p.	18-19

Western Pennsylvania

145-155 vis. 10 p.t. bright stock	43
150 vis. 0 p.t. neutral	43

CRUDE-SCALE WAX

Mid-Continent

130-132 A.S.T.M. melting point	6.75-7.75

Foreign Oil Operations Marked by Uncertainties

(Continued from page 161)

Arabia we have to construct in association with the government, roads, ports, railroads, and many other things. As to the payments made to the government itself, you will recall that the royalties in the United States run from 1/8 to 1/6 of the production. Royalty in the Middle East is not expressed in these terms. The royalty on the Arabian American concession is four gold shillings per ton. Under ordinary circumstances with gold at $35 per ounce, a gold sovereign would be worth $8.23. This would mean that the royalty on Saudi Arabian oil is approximately 23 cents per barrel. However, gold sovereigns have been sold at a premium in Far East markets, and this has raised some doubt as to the conversion factor. This matter is now under discusion with the Saudi Arab Government. As a result, we cannot tell you today what royalty rate we are paying. I would call your attention, however, to the fact that 23 cents per barrel paid on the grade of crude we produce is a higher royalty rate than the usual 1/8 paid in the United States on a similar grade at the present time.

Services by the Company

Aside from paying this royalty, we perform, and will in the future perform, numerous services which industry does not perform in the United States. These services include such things as the maintenance of hospitals whose surplus facilities are open to the general public, assistance in the building of sanitary facilities, and provision of water supply and electricity without profit.

If we set down a figure for all these things I have mentioned above and made a guess as to what they might total, we come to another factor which is most elusive and that is the risk in making large investments in foreign lands. I am not speaking here of internal questions inside Saudi Arabia, but rather the effect of international affairs upon our operations. In the first place, our ability to carry on our operations depends upon the peace of the world, upon the lets and hinderances to that much desired state which may be imposed by princes, principalities, and powers.

There are also economic risks associated with the actions of governments which may bear seriously upon our operations. For instance, embargoes on products originating in Saudi Arabia, exchange regulations which make it impossible for us to sell in certain markets, quotas, restrictions on the export of supplies, shipping blockades, and other obstructions to the free flow of oil caused by local disturbances. I know of no way to guess at the importance of these political and economic factors in any calculation made with reference to cost. Some large factor must be included to take care of these risks and the rate of profit, and the amortization of investment must perforce be made at a greater rate than that used in the United States, otherwise we cannot justify our taking such risks. How much greater these may be I do not know.

Efficient Operations

Foreign oil is thus competitive with that from domestic fields only because of the physical conditions surrounding the oil and the fact that most of the concessions are large and we drill on more widely spaced centers than in the United States. For instance, if the East Texas field had been found in Saudi Arabia, we would have probably drilled a fraction of the number of wells actually drilled. It is this ability to operate the foreign fields at technically the most efficient level which makes them competitive and offsets other disadvantages which are so well recognized by everybody who has operated abroad.

The great reserves which are being found in Saudi Arabia, Kuweit, Qatar, Iran, and Iraq have a potential for good beyond measure. The monies which are poured into the Middle Eastern countries as a result of royalties and wage payments will tend to revive and reestablish countries long oppressed by alien rulers whose freedom only originated after the First World War.

As the developers of one of the great concessions, we conceive that we have large responsibilities to a number of different groups. In the first place, we are developing the oil of the Saudi Arabs, converting it into products and distributing it on the markets of the world. We occupy, therefore, a special relationship to the Saudi Arab Government and produce the fields efficiently, pay the government a fair return for the extraction of the oil, work with that government in the development of the country, pay fair wages and maintain good working conditions. Because we are an American company we will develop our concession in such a way that the American public can be proud of the record we make. We are supplying oil for the Navy. Beyond that, we are trying to be of service to the people of thc world.

Many Interested in Operations

Last, but not least, a number of American citizens have furnished capital for this development. I would guess that possibly as many as 5 per cent of the people of the United States have some direct or indirect interest in the financial prosperity of the company.

I find in going through my notes that I have failed to mention our plans for the movement of the oil. The Trans-Arabian Pipe Line Co. will construct a 30-31-in. line from Abqaiq to a point on the Levant Coast which it expects to complete in late 1949. We are also constructing a 20-22-in. line from our Abqaiq field to Ras Tanura to supplement our present facilities on the Persian Gulf. This will be completed next year. When these lines are completed and when the wells ancillary thereto are drilled and stabilizers constructed, we will be able to put on the Levant Coast 300,000 bbl. daily of crude oil and on the Persian Gulf Coast about 400,000 bbl. daily. Under the present tanker rates of the Maritime Commission, it costs $1.70 for a tanker to move a barrel of oil from our Ras Tanura port to New York. From Port Said or a port on the Levant Coast to a harbor in the eastern part of the United States, the cost is $1.04 per barrel. We expect these tanker rates will be reduced in time. It is not necessary, however, for oil from Saudi Arabia to move to the eastern United States to make available crude oil to the United States. Oil to supply the Mediterranean markets has been derived from the Caribbean (Trinidad, Venezuela, and Colombia). This oil shipped into European markets has reached figures of over 500,000 bbl. daily and at present is running at the rate of 400,000 bbl. daily. The replacement of this oil in the markets of western Europe by oil from the Near East will naturally make available to the United States oil from the Caribbean countries. This is the normal flow of trade.

There is no shortage of oil in the world. There may not be a serious shortage of oil in the United States at the present time. I am told there is a shortage of transportation, the means to get the oil to the markets and that this has resulted from the fact that American consumption has risen more rapidly than expected. I might pause to remark that this has been the history of the oil industry since its inception.

I believe we will need all the oil we can find in the United States and will have to supplement it with oil we can bring in from outside. I might point out that this growing demand for oil is spreading to many places in the world. If one had prophesied 5 years ago that a British minister of fuel and transport would try to force British firms to stop using coal and turn to oil; if one had predicted a French plan for reviving industry by the transformation of a good deal of French manufacturing from coal to an oil basis, one would have been dubbed a false prophet, yet this is the case today. Oil is so easy to use, the reserves are now known to be so large, that there is no reason why anybody who can efficiently use oil, should not do so. The great reserves of the Near East have made it possible for all the people who wish to use oil to be assured of a supply which they can use for many years.

EQUIPMENT MEN ... in the News

Caterpillar Names McClelland

C. K. McCLELLAND

C. K. McClelland, Colonel, U. S. Army (retired), has been named a district representative contacting Caterpillar distributors in portions of Texas, according to an announcement by J. J. Valentine, central division sales manager of Caterpillar Tractor Co., Peoria, Ill.

McClelland succeeds Carl F. Schober who has become associated with Wm. K. Holt Machinery Co.

Goodrich Awards Service Emblems

There are now more than 5,200 active employes with two decades or more of company service on the rolls of the Twenty Year Service Club of The B. F. Goodrich Co., following the recent summer pin presentation ceremonies of the club.

John L. Collyer, company president, awarded service emblems to 15 employes with 40 years of service, 118 to 30-year employes, and 308 to 20-year veterans.

Mid-Continent Store Opened in Kansas

The formal opening of Mid-Continent Supply Co.'s new store at Great Bend, Kans., was recently celebrated with a barbecue and open house. Personnel at the new store includes V. H. Haston, store manager, P. K. Confer, field salesman, A. R. Tune, and E. G. Mog. Other company representatives who officiated at the opening were S. R. Clinkscales, division manager at Tulsa, and Nick Carter, district manager at Wichita.

Rector Appoints Bolieau

L. L. Rector, president of Rector Well Equipment Co., has announced the appointment of R. M. Bolieau as California representative with headquarters in Tulare. Bolieau entered the oil business in 1928 with Axelson Machine Co. For the past 19 years he has been Mid-Continent and Rocky Mountain representative for the D&B Division of Emsco Derrick & Equipment Co.

Marley Promotes Two

Lyle A. Christensen has been promoted to general sales manager of Marley Co., Inc., manufacturers of

L. A. CHRISTENSEN

R. T. JENKINS

cooling towers, nozzles, and other water cooling equipment, following 5 years as sales engineer in the New York office.

Ray T. Jenkins has been promoted to assistant general manager. Jenkins entered the Marley organization in 1933 as sales engineer, and since then has headed the Dallas, Tulsa, and Houston offices and has served as general sales manager since 1944 when he came to the Kansas City office.

G. H. Westby, president of the Tulsa Chamber of Commerce and president of Seismograph Service Corp., Tulsa, is shown here shortly after accepting delivery on his new Beechcraft Bonanza at Beech Aircraft Corp. plant in Wichita

Flint Steel Warehousing Aristoloy Bars

Flint Steel Corp. (formerly Tulsa Boiler Machine Co.) of Tulsa, announces that it is now warehousing Aristaloy alloy steel bars, effective July 1, 1947. Aristoloy is the trade name of electric furnace steels produced by Copperweld Steel Co., Warren, Ohio.

Weis Returns to U. S.

In two wide aerial circles over the oil centers of South America and Europe, Elmer Weis, vice president of Pacific Pumps, Inc., Los Angeles, one of the Dresser Industries, has completed a survey which brings his company abreast of the latest developments.

Weis left Los Angeles by air early this year to sweep into the South American refining and producing centers. Returning from this South American trip, Weis left immediately for a tour of the European refineries. This journey during April, May, and June, carried him to England, France, and Holland.

Firm Changes Name

As a result of an expansion program to include various other types of products with its service to the drilling industry, the firm name of Rufnek Chemical Co., Houston, has been changed to Rufnek Products Co. Jack Barton and Jack Bennett are partners in Rufnek Products Co. Organized less than a year ago, Rufnek Products Co. has specialized in water treatment and analysis.

Alco Appoints Gunter

Addison Y. Gunter has been appointed southwestern district sales manager of Alco Products Division of American Locomotive Co. with headquarters in Houston. Gunter, a graduate of Texas A. & M., has been associated with the division since 1937. He served as production engineer, director of development, and assistant manager of sales and engineering prior to his new appointment.

Strain Made District Manager at Houston

H. A. STRAIN

G. J. Halpin, general sales manager of American-La France-Foamite Corp., announces that Harold A. Strain has been appointed district manager of the Houston office, succeeding A. E. Canaday, who recently resigned. Strain has represented Afco for 11 years in the New York City area.

Barium Purchases Plant

Barium Steel Corp. announces purchase of plant and other physical assets including inventories and good will of George King Co., Inc., producers of iron and steel castings at Sheffield, Ala. The King plant and business hereafter will be operated by and under the name of Sheffield Iron & Steel Co., a Barium subsidiary. The plant includes steel and iron foundries, office building, warehouses, and storage houses.

Kime Joins Ransome

Ransome Machinery Co., a subsidiary of Worthington Pump & Machinery Corp., has appointed Allan B. Kime as eastern regional manager in charge of the sale of Ransome positioning and turning roll equipment. Kime has been associated for the past 12 years with Federal Shipbuilding & Drydock Co., Kearny, N. J., in supervisory capacity in charge of welding production methods and procedures. His headquarters will be at the Ransome plant, Dunellen, N. J.

Failing Men Help in Bomb Research Work

A Failing 1500 Holemaster drill was purchased by the Government from Geo. E. Failing Supply Co., of Enid, Okla., especially for determining the subsurface effects of the atomic bomb blasts loosed on Bikini and two Failing employes were flown to the island to assist in the research work. The two Failing men who went to Bikini are E. L. Alexander, chief engineer, and V. C. Mickle, drilling instructor. Mickle will act as superintendent of drilling and Alexander will be the technical adviser.

E. L. ALEXANDER

V. C. MICKLE

Several holes ranging from 200 to 300 ft. in depth were to be drilled at strategic points on the atoll and a complete set of cores taken for future study of the blast reaction. It also is planned to drill one hole to a depth of over 2,000 ft.

In addition to studying the effects of the bomb the scientists plan to make a detailed study of the coral structure of the island.

Both the Army and Navy departments are cooperating with U.S.G.S. officials in the work, which is expected to continue for a period of about 4 weeks.

Approximately 75 professors of mechanical engineering from the leading colleges in the United States recently witnessed a field test run of International Harvester Co.'s giant new TD-24 crawler tractor during a day-long session at the company's diesel engineering facilities at Chicago. The demonstration was part of a program sponsored in connection with a week-long conference of teachers of diesel engineering held in Chicago under the auspices of the Diesel Engine Manufacturers' Association

Cunningham to Manage Devine Plant

CUNNINGHAM, JR.

H. K. Porter Co., Inc., has appointed John F. Cunningham, Jr., as manager of the J. P. Devine Manufacturing Co. plant at Mount Vernon, Ill. Cunningham formerly was research engineer and manufacturing division engineer for Elliott Co., Jeannette, Pa.

Paxton Vice President Of Jessop Steel Co.

Richard M. Paxton, Jr., has been elected a vice president of Jessop Steel Co., Washington, Pa., according to an announcement by F. T. H. Youngman, president. Paxton joined the company in 1924 and has served in various capacities in all of the company's production departments and laboratories. In March of 1927, he was transferred to New York City, where for the past 20 years he has been in charge of Jessop's New York branch office.

Fagan to Long Beach

Robert D. Fagan has been appointed sales representative for International Cementers, Inc., in the Long Beach district to replace M. W. "Monk" Cook who has resigned to do selling work in the Near East.

Bob Fagan was with Pacific Cementing from 1937 until it was made International Cementers in 1940 as cementer district manager and special representative.

"Monk" Cook leaves 7 years' service with International Cementers, Inc., as district manager and sales representative to become sales and service representative for Byron Jackson Co., Chiksan Export Co., Falcon Products, Inc., International Derrick & Equipment Co., Patterson-Ballagh Co., and the Security Engineering Co.

Jack S. Smith, manager of operations and sales for International Cementers, Inc., returned last week from a 2-month trip to Europe. He contacted personnel of oil companies in England, Holland, France, Denmark and Egypt.

Jackson Office Opened

Continental Supply Co. has opened an office in Jackson, Miss., at 702 Deposit Guaranty Bank Building. This office is headquarters of B. L. Hindman, asisstant district manager for the state. Hindman was formerly located at the Brookhaven store.

Classified Advertising

The Market Place for the Oil Industry

UNDISPLAYED

All ads except Situations Wanted, 10 cents a word. Minimum charge, $2.00 per insertion.
Situations Wanted ads, 5 cents a word. Minimum charge, $1.00 per insertion.
Centered Line, any ad, 75 cents.
Box Numbers count 9 words when replies are to be sent to our Tulsa Office. Replies forwarded without charge.

DISPLAYED, PER INCH

$9.00 per column inch per insertion. One-point border and 12-point capitals are allowed. Larger type sizes not accepted.

All classified advertising payable in advance.
10% Discount if 3 insertions are ordered at one time.
COPY DEADLINE, 9:00 a.m. Monday prior to each week's issue.

THE OIL AND GAS JOURNAL
P. O. Box 1260, TULSA, OKLAHOMA

EQUIPMENT FOR SALE

FOR SALE: Six New Kobe, 2½ inch tubing insert, pumps, one Triplex—Bargain for immediate sale. Ben Beckham, Jr., Box 134, Overton, Texas. Phone 3921.

FOR SALE: 1—14" x 14" Ideal horizontal twin cylinder steam drilling engine. 2—15¼" x 3½" x 20" Ideal steam slush pumps. Excellent condition. Priced right.
Lucey Products Corporation,
Tulsa, Oklahoma.

1—New R. L. Double Drum Cardwell Unit powered with WAK Waukesha engine; 1—R. L. Model, Double Drum Cardwell in first class condition, new MO-893 Buda engine, new bearings in jack shaft and lower drum and relined brakes. Both good buys. Write T. C. S. Drilling Company, Rangely, Colorado.

FOR SALE: Shaffer power draw works, powered by two J. L. 1335 Buda engines compounded. Suitable for 5,000 foot work. In A-1 condition. Price $7,500. Terms. Melton Well Service, Box 1360, Seminole, Oklahoma.

FOR SALE

IN PERFECT CONDITION

2—4" Landis Pipe Cutting and Threading Machines.

2—2" Saunders Pipe Cutting and Threading Machines.

Lever Grip, complete with LANDIS dies, die heads, belts, shafting and MOTOR.

ATTRACTIVE PRICE

ALBERT & DAVIDSON PIPE CORP.
2nd Avenue and 50th Street,
Brooklyn, 32, N. Y.
WIndsor 9-6300

EQUIPMENT FOR SALE

FOR SALE: Franks Single Drum 4000' Pulling unit, 10" x 8" x 60' mast, Double friction clutches, mounted on 5 Ton GMC Tandem truck. This unit is new, having done about 5 mo. work. J. A. Rives, Borger, Texas.

STEAM DRILLING ENGINE, Gardner-Denver, Model DEA-1000-12" x 12", horizontal twin cylinders, excellent condition. Write or call Joseph Weidenhoff, Inc., 4340 W. Roosevelt Rd., Chicago, Ill., Mr. D. R. Kennedy, Nevada 3233.

PRICED TO SELL: 20—Size 2,000 gal. Gasoline Tanks mounted on Semi Trailers, 4 tires, size 900 x 20, Budd Wheels. Complete with transfer unit, hose, air brakes. Good for Oil, Tanks, Water, Gasoline, etc. Mfg. by The Heil Company. Independent Tank Company, Seminole, Oklahoma, Box 102, Phone 977.

1 STAR 45 ST Spudder with Hercules engine. Both in excellent condition. No tools. Located 10 miles East of Drumright, Okla. 1 Ft. Worth Super D Spudder with practically two strings of tools, located on Lysite Mountain, Wyoming. Travco Equipment Company, 110 Midco Bldg., Tulsa, Oklahoma. Phone 5-2251.

FOR SALE: On Lease near Gladewater, Texas, 100 HP Superior Gas Engine and National G-100 Geared Power. Contact Gladewater office or Patridge, Cities Service Oil, Bartlesville, Okla.

FOR SALE OR TRADE
NATIONAL ROTARY RIG
Complete with derrick and drill pipe.
D. M. HAWKINS
310 Thompson Bldg. Phone 3-0069
Tulsa, Okla.

NEW A.P.I. STORAGE TANKS

2—25,000 bbl., 80' x 30'

2—40,000 bbl., 100' x 30'

Above tanks knocked down and fabricated for welded construction. Each tank complete with steel roof, structural supports, accessories, and welding rods. Complete Bills of Material and erection blueprints available upon request. Location: Compton, Calif.

HORWITZ PIPE & SUPPLY CO.
Tulsa, Okla.

FOR SALE
STEEL STORAGE TANKS

19—10,000 Gallon Capacity Tank Car Tanks

CLEANED PAINTED TESTED
Located in Oklahoma

IRON & STEEL PRODUCTS, INC.
42 years' experience
13412 S. Brainard Avenue
Chicago 33, Illinois. PHONE BAYport 3456
"ANYTHING containing IRON or STEEL"

EQUIPMENT FOR SALE

FOR SALE: New 3" Drill Pipe with Tool Joints standard weights R-2. Box B-734, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE: New 5" x 10" Worthington TYPE KMS-1 Pump. Box B-733, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE: Two 12,000 gallon gasoline tanks and one 10,000 gallon overhead tank with steel frame, rotary pump with three horse power electric motor together with pipe and fittings. Security Investment Company, Phone 5259, Abilene, Texas.

WICHITA SPUDDER and string of drilling tools, sell or trade near St. Louis. J. B. Woolsey, 804 N.W. 35th, Oklahoma City, Oklahoma.

FOR SALE: Ingersoll-Rand Imperial Type 10, 2 stage belt-driven compressor with 110 hp. twin cylinder Bessemer gas engine with 20" x 54" wood frame galvanized iron building, 4 scrubber tanks, circulating coils with heavy welded tank 10' x 24' x 10" deep, air compressor with volume tank complete. Phone or write W. R. Bowman, 214 Kennedy Bldg., Tulsa, Oklahoma. Phone 2-2633 or 6-6960.

PRICED FOR QUICK SALE

—One—12 x 12 Lucey Twin Cylinder enclosed oil bath Steam Drilling Engine Serial No. WL 234-GM 6000.

WILL H. SMITH
Box 686, Ardmore, Okla.

LATEST TYPE
DIESEL AIR COMPRESSOR
300 H.P.

Clark Right Angle Model D32, 3 Cylinder 14" bore 14" stroke Air End 21" and 12½". Complete with all equipment, wrenches, etc. Machine operated only three months in Clarks Dresser Plant at Bradford. Now located near Bradford, Penna. Crated for immediate shipment.

Price One Half of Present Quotation
Address:

NORTHERN ORDNANCE INC.
W. M. Cordner—Sales Manager
Minneapolis, Minnesota
Telephone: Granville 7201

THE WONDER PUMP

Vane type rotary pump—400 Gals. per hour—pulls 29" of wet vacuum of water. Weighs 3¾ pounds. For water, gasoline and oil up to 300 Viscosity. We have the largest stock of reconditioned and non-reconditioned steam, centrifugal and rotary pumps in the Southwest.

We also repair and recondition Customer pumps.

BUYERS SERVICE & ENGINEERING CO.
Joe Forney—114 W. Archer—Tulsa, Okla.
Phones 3-8123—3-6755. Res. 3-0434.

$52,500
COMPLETE 700 h.p.
Rotary Drilling Rig

Refer June 21 and June 28 issues of The Oil and Gas Journal, classified section, or write for detailed inventory.

Lucey Products Corp.
910 So. Boston Tulsa, Okla.